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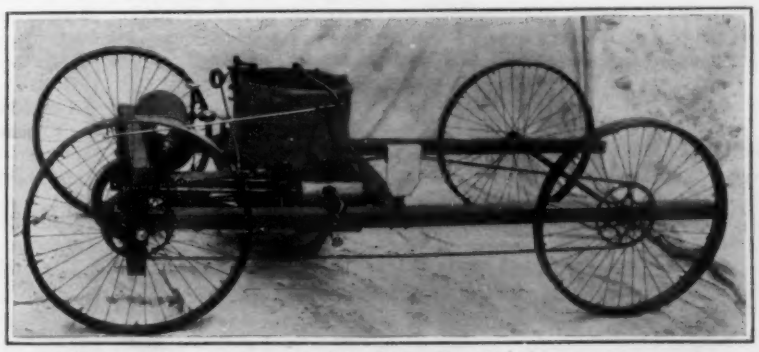
Controlled by cables and windlasses from the trenches of the attacking forces, the steam-propelled land torpedo could rush across No Man's Land with the speed of an express train, immune from rifle and machine-gun fire and a most elusive target for artillery fire

Torpedoing the Enemy's Trenches as a Preliminary to Infantry Attack

HOURS, days and weeks of artillery preparation of the most intense variety generally precedes an infantry assault on the highly organized Western fighting front of Europe, we are told by the press dispatches. Barbed wire, backed up by large numbers of machine guns, has given such a tremendous advantage to the defense that an infantry attack cannot hope to succeed unless these arms of the defense have been previously wiped out of existence. So by the use of intense, localized artillery fire—and at other times by the use of mines—machine-gun emplacements and barbed-wire entanglements are obliterated in order that the attacking infantry waves may meet the defenders on more equal terms.

Artillery preparation is costly, even in a war where cost seems to be the last consideration. Merely to eject a three-inch shell out of a rapid-fire field gun and thus place a steel package containing thirteen ounces of high explosive in the enemy's trenches or barbed-wire entanglements, costs about $25; and when this is multiplied by a few hundred thousand and when it is remembered that a 3-inch shell is only an accompaniment to the roar of the 6-inch, 8-inch, 12-inch, 14-inch, and even 16-inch shells, it soon becomes evident that artillery preparation is tremendously costly. Then again, forgetting the cost phase momentarily, the artillery preparation is not always satisfactory because it gives the enemy ample warning that an infantry assault is about to be delivered, thereby enabling him to take such defensive measures as may be deemed necessary, among them the bringing up of reinforcements to the threatened points. Obviously, the element of surprise is impossible with the use of artillery preparation.



Chassis of the steam-propelled land torpedo, showing the arrangement of the power-plant components

Mine explosions, while retaining the element of surprise to some extent for the attackers, can only be brought about after considerable work—and even fighting—underground. An aggressive enemy is always certain to counteract mining operations by countermining, and as a result the use of mines is rather limited for extensive assaults.

Realizing the limitations of modern attack in the face of the tremendous advantages of modern defense, numerous inventors in the warring and neutral countries have been hard at work endeavoring to substitute a new weapon of attack for artillery preparation and mining. Among the most promising ideas brought to light is a land torpedo or a torpedo on wheels, which has been suggested by an Englishman, Stafford Talbot, of London, and worked out by V. A. Villar of New York city. Mr. Talbot, who was in Russia during the early months of the war on a semi-official mission, gives credit for the conception of the idea to Grand Duke Serge, who at that time was in charge of Russian artillery.

The land torpedo is nothing more than a torpedo on wheels. The original idea was to make use of a modified gasoline automobile chassis, but since this was found impractical, the present plans call for the use of a chassis equipped with a steam-power plant. With proper means of control through cables, the idea is to launch such torpedoes against the enemy's trenches and barbed-wire entanglements and to blow up the charges at the propitious moment, in this way preparing a breach for the infantry assault.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs

The Great Emergency

IF ever there was a time when a great country was confronted with a stupendous crisis in its history, that country is the United States, and that time is today.

The war upon which we have embarked is so complicated, so filled with elements of uncertainty, that no man can predict to which side the tide of final victory will turn.

And we say this with full realization of the fact that the United States has brought to the side of the Allies unlimited wealth, vast industrial resources, a great navy, and millions of men for the creation of a mighty army.

Six months ago our entrance into the war would have meant the absolute triumph of the Allies, for six months ago Germany was not prepared to commit itself to the horrible barbarities of unrestricted submarine warfare. Today, this twentieth century piracy is in full swing, and these modern successors to Morgan and Captain Kidd are sending helpless noncombatants to the bottom of the sea with a cold-blooded ferocity, the contemplation of which would make even a Morgan blanch.

We have spoken of the present as the greatest crisis in our history, and in such a crisis it is imperative that we should keep our judgment well balanced and preserve our vision absolutely clear. In determining what things should be done and in what order they should be done, we must maintain a just sense of proportion and a true perspective; and if we do this, we shall see at once that absolutely the most important peril in this crisis is the submarine war. Upon the issues of that war depend the alternatives of an early and complete crushing of German militarism in Europe, or of our having ultimately to fight that militarism in our own waters and within our own territory.

Therefore, we do not hesitate to say that the imminent and imperative duty of our authorities is to bend all the strength of our Navy, actual and potential, to the defeat of the German submarines; for we repeat that upon the success or failure of the German U-boats depends the winning or losing of the great world war.

To many of us it has seemed an amazing thing that Germany, hard pressed as she now is, outmatched in money, men and munitions, should deliberately have added this great country to her burdens. Why did she do it? Feather-brained her philosophers and professors may be, but feather-brained her military and naval men are not; and when, by sinking our ships, they deliberately drove this country to take arms against them, they did so because, after a careful estimate of their ship- and engine-building facilities, they came to the conclusion that they could set submarines afloat upon the high seas in such numbers that they could shut off the United States from Europe, and thus at once starve out the Allies and neutralize the effect of our entrance into the war.

Can the Germans do this? Their success depends upon two things; first, upon their submarine-building capacity, and second, upon the capacity of the Allies to build anti-submarine craft and set afloat new shipping at such a rate as to defeat the submarine raid.

Now, it is just here, in the construction of anti-submarine war craft, that the United States Navy should at once exert its undivided efforts. If our naval authorities get the true perspective upon the great crisis in which we find ourselves, they will at once shut down work upon battleships, battle-cruisers, aye, and even upon our fast scouts, which cannot be ready until the war is over, and they will lay down to the full limit of our shipbuilding capacity, destroyers and sea-going submarine chasers.

The immediate duty of the Navy, as we see it, is the construction of a vast fleet of large, sea-keeping, powerfully armed surface ships, and their dispatch into the submarine infested area at the rate of at least half a dozen surface ships for every one of the sub-surface craft that the Germans are able to set afloat.

What is the submarine-building capacity of Germany? How long does it take her to build a U-boat, and how many can she turn out within the month? Nobody outside of Germany can answer that question. But we can make a pretty good guess, not at the number of submarines that she is building, but at the number that she could build, if she wished to. And because she has stated that in this submarine warfare lies her one last chance of victory, we may as well make up our minds to the fact that Germany is dropping all construction on capital ships, and is bending the whole of her ship- and engine-building strength to the construction of submarines.

Recently we published an estimate of the building ways accommodation for submarine construction in the public and private yards of Germany and we found that without constructing any new ways, she could have no less than 530 submarines under construction at one and the same time. As to the time necessary to complete a submarine, we recently asked the president of one of our large shipbuilding yards how long it would take him to build submarines, if they were constructed to a common plan, and if the whole of his plant was given up to the work. He told us that, under such conditions, he could build them at the rate of five months to a submarine. So that if we allow six months for the construction of a German submarine, it is quite conceivable that by the autumn of this year, Germany may have set afloat 500 U-boats additional to the two hundred or three hundred, or whatever number it may be, which she has in commission today. By the spring of next year she may have a thousand or twelve hundred boats at work. The construction of the hulls would be the least difficult part of the problem, and as to the engines, Germany is the home of the heavy-oil Diesel engine. Manufacturing the periscopes, gyroscopic compasses, and other delicate appliances should be possible; for Germany has been long renowned for her optical and other fine instrumental work. Furthermore, the total number of submarines that have been sunk is not nearly so large as is popularly supposed.

Let us then be wise and assume the worst. Let us take it for granted that Germany is able to build and is, indeed, now building submarines at the rate of a hundred a month and a thousand to twelve hundred a year. That she is launching submarines at some such rate is suggested by the recent rapid increase in the number of sinkings. Therefore, it follows that unless we build anti-submarine craft faster and in far greater numbers than Germany can build submarines, she is in a fair way to make good her boast and force an inconclusive peace upon the great alliance into which we have now entered.

Personal Names in the Newspapers

WHEN a soldier is killed in battle, it is usually a grain of comfort to his family to have his name duly and properly recorded in the casualty list—the official "roll of honor." A slight error in spelling, in such a list, would often be equivalent in effect to an omission. Thrice-happy, says Byron, is the man

> whose name has been well spelt
> In the despatch; I knew a man whose loss
> Was printed *Grove*, although his name was Grose.

If Byron were living to-day he would perhaps devote an approving couplet to our English contemporary, the *Times* for the conscientious way in which that journal corrects, by means of "errata," even the most trifling errors that occur in its lists of British casualties incidental to the present war; errors, be it remarked, not due to the carelessness of printers and proofreaders—such errors being hardly ever found in the columns of the *Times*—but to sources external to Printing House Square and inevitable in the hurly-burly of current events. We have before us an extreme case of this kind, in which a certain Lieutenant Colonel MacEwen figures in an errata list because his name had previously been printed "MacEwan," though correct indications of his rank, initials and regiment left no doubt as to his identity.

The leading newspapers of America undoubtedly surpass those of the Old World in *big* things. Is it too much to hope that they may some day equal them in little ones? Without venturing to offer a counsel of perfection—thereby perhaps getting our attention sharply called to our own imperfections—we feel moved to urge, as a practical desideratum, the exercise of more care in the recording of personal names in the daily press of this country.

This question might be discussed from several points of view. In the first place there is the reader who finds (perhaps for the ten thousandth time) that his *own* name has been bungled in the papers—but in this case the result is irritation and not misinformation. Then, there is the point of view of the journalist, who is prone to claim that the conditions under which newspapers are published preclude a high degree of verbal accuracy. The answer to this contention is that, while perfection is impossible, a higher degree of accuracy might certainly be attained, if it were clearly recognized as desirable. This brings us to the point of view of the reading public with regard to names, not generally familiar, which are so badly mangled in the press as to quite obscure the identity of the persons to whom they belong. No one can blame the newspapers for occasional mistakes of this kind; but we wish to emphasize the fact that such mistakes are excessively, not to say scandalously, frequent; so frequent that they are accepted as a matter of course.

News of scientific events is especially subject to this defect, because the names of scientific men, with a few exceptions, are not familiar to the average journalist. Again and again we have vainly endeavored to learn from the dispatches in our daily papers who were the members of this or that exploring expedition, or what particular privat-dozent at a German university (for example) had made some interesting discovery. Names we found in plenty—far too many of them. "Wagner" in one paper, "Wegener" in another, and "Wenger" in a third; or perhaps all three in one and the same column. But the identity of the person or persons in whose achievements we were keenly interested remained problematical.

Whether it is the telegraphers or the printers are more to blame for these things matters little. In one case collective, and in the other individual, efforts on the part of newspaper publishers would reduce the evil to a minimum.

The Divining-Rod

THERE are certain time-honored popular delusions, the refutation of which furnishes steady occupation to the scientific authorities. Such tasks of enlightment enter into the routine of many scientific bureaus of our paternal government, and with the progress of time the work does not seem to grow any lighter. Day in and day out the Department of Agriculture is kept busy telling farmers not to worry about which phase of the moon is best for planting their crops. The Weather Bureau has no respite from the task of exploding the idea that the exploding of gunpowder will cause rain. And now we learn that the Geological Survey has its own bugbear, in the shape of the divining-rod.

The trials of the last-named institution have had a happy result, so far as the world at large is concerned, for they have prompted the publication of an entertaining little pamphelt entitled "The Divining-Rod; a History of Water Witching," prepared by Arthur J. Ellis and published as Water-Supply Paper 416. This paper presents not only a succint and up-to-date history of a strange delusion, but also a bibliography of the subject, containing upward of 1,900 titles, which range in date from the middle of the sixteenth century down to the year 1916. It appears that the survey is besieged with inquiries, in this second decade of the twentieth century, concerning the efficacy of water witching—to say nothing of analogous expedients for locating minerals, oil, hidden treasure and elusive criminals—and is also frequently urged to undertake investigations of this most thoroughly investigated and discredited subject.

Our progressive age has improved considerably upon the forked hazel rod of the old-fashioned dowser, though this is by no means obsolete. Today the credulous public is offered sundry "instruments" which embody the idea of the divining-rod, but are supposed to depend for their operation upon magnestism, radioactivity, and what-not. The Geological Survey invariably advises inquirers not to waste their money upon any such devices or upon the services of alleged "water witches."

We have not space here to summarize the fascinating history of the divining rod. Mr. Ellis's memoir may be obtained at the modest price of ten cents from the Superintendent of Documents, in Washington, by anybody who wishes to explore this subject. It seems proper, however, to point out the fact that there are two sides to the question of "water witching."

The article "Divining-rod" in the current edition of the Encyclopædia Britannica lays somewhat more stress than Mr. Ellis has done upon the possible grains of truth there may be in the chaff of this persistent delusion. W. F. Barrett, professor of physics at the Royal College of Science for Ireland, published in 1897 and 1901 two large volumes setting forth his investigations of the subject, the general conclusion of which is that in some cases a species of clairvoyance (*i. e.*, some form of supernormal but not supernatural "suggestion") may be successful in locating underground water; though the exact process involved, like all else relating to the operations of the subconscious mind, remains obscure. This is not, of course, an argument in support of any mechanical connection between the behavior of the divining-rod and the presence of water, or of the merits of any form of apparatus in the hands of a nonsensitive operator.

There is, after all, a vast and misty borderland of human knowledge into which the average man of science does not venture to penetrate. It remains true that, broadly speaking and for practical purposes, rhabdomancy is a snare and a delusion.

Electricity

Flame Carbon Arc Lamps.—For factories, warehouses, mills and other large industrial plants where the intensity of illumination should be uniform over the working surface, as well as for street, park and boulevard lighting, the flame carbon arc lamps give excellent and efficient illumination. Their exceptionally substantial construction and wide light distribution make them one of the best lamps to use in outdoor construction work, in quarries, in railroad yards and other similar places. Their intense illumination at low cost also makes them very desirable for display lighting in front of stores or theaters, or for the lighting of public squares.

Insulator for High Tension Trolley Lines.—As a result of the higher direct-current voltages coming into use for the operation of electric railways, there has lately appeared a special insulating suspension for trolley wires. It is designed to meet conditions where 1,200 volts and 1,500 volts are used, and insulates the trolley wire from the cross span or bracket. The new suspension has a porcelain body into which a specially designed stud capable of withstanding a strain up to three tons, is cemented. A malleable-iron span yoke is provided for attaching to the span wire, while a malleable-iron wheel guard affords protection against "wild" trolley poles.

Flood-Lighting and Property Protection.—Prominent among the many precautions exercised in protecting public and private property since the United States entered the war is the flood-light. With the many excellent forms of flood-lights now on the market it has been comparatively simple for private corporations and municipal and Federal organizations to flood-light buildings, bridges and works at night as a supplement to vigilant armed guards. Indeed, it may be said that the flood-lighting of property is the first measure of precaution, since it makes it practically impossible for anyone to approach without being detected. The flood-light is being largely employed in New York city for illuminating the piers and under structure of the bridges at night.

Sensitive Selenium Cell.—Having a sensitiveness a thousand times greater than the ordinary types, the new selenium cell developed by Fay C. Brown of Berkeley, Cal., is of more than passing interest. In his patent Mr. Brown states that the chief feature of his cell is in the production of the crystals by sublimation and then allowing the crystals to absorb the gas argon, helium or neon at a temperature below that of the crystal formation. Both large and small crystals produced by this method have been investigated, and the inventor states that the crystals, even those of microscopic size, have shown no signs of deterioration even after being exposed to most intense light twenty-four hours a day for thirty-five days in succession. One of his selenium cells was subjected to ordinary conditions and showed the same sensibility after a period of a year.

Amateur Wireless and the War.—Nothing could have been more efficiently conducted than the dismantling of amateur wireless stations following the declaration of war by our Government. In New York city, for instance, all the amateur wireless stations were dismantled in a few days' time after the official order was given. In most instances the amateurs were prompt to follow out the instructions, but in a very small number of instances the police undertook to take down the aerials which remained in place in defiance of the Government's orders. As a whole, the work was completed in a much shorter time than had been believed possible, largely due to the fact that the amateurs themselves realized the importance and necessity for the orders and were impelled by purely patriotic motives in hastening their execution.

Novel Liquid Rheostat.—Measuring 3 by 4 inches overall, a unique type of liquid rheostat has recently been placed on the market, which is entirely automatic in its operation and which permits current to be gradually applied to lamps, motors, or other current-consuming devices. The rheostat is combined with a snap switch. Briefly, it consists of a wall box, a flush plate and a cylinder which incases the container for the liquid and also a time device which retards the action of the switch to a predetermined time. The liquid container is divided by a perforated partition, one compartment containing the electrodes which are tapering and so arranged that the encroachment of the liquid on and around them lowers the resistance, allowing the current to build up to normal, at which time the cut-out short circuits the liquid. On the other hand, continues the *Electrical Age* in describing this device, as the liquid leaves the compartment, draining the electrodes, the resistance is increased until the circuit is opened, then a cut-out performs its function cutting the container entirely from the circuit. The new rheostat can be roughly handled, and overloading does not injure it. The liquid cannot be extracted and the original charge will last four years, when it can be renewed. It is claimed that the rheostat requires only two spoonfuls of water to each kilowatt controlled.

Science

The Deepest Mine in the World, according to a note in *La Nature*, is the Morro Velho gold mine, near Ouro Preto, Brazil, with a depth of 1,800 meters (more than 5,900 feet). This mine has been in course of exploitation since the eighteenth century. Its depth exceeds by 700 feet that of No. 3 shaft of the Tamarack mine, in Houghton County, Mich., which has commonly been cited as the deepest in the world.

Grasshoppers at Sea.—The master of the Norwegian bark "Robert Scrafton," bound from Liverpool to Pensacola, recently encountered a swarm of grasshoppers when about 1,200 miles from the African coast—the nearest land. A specimen insect was forwarded, through the Weather Bureau, to the U. S. Bureau of Entomology, where it was pronounced to be *Schistocerca tartarica*. This species is a powerful flier, and has been taken far at sea on previous occasions. In the present case its flight was evidently aided by the steady northeast trade winds.

Preservation of Livingstone Relics.—Measures have been taken by the British Government to preserve the remains of Dr. David Livingstone's house at Koloben, or Kolobeng, Bechuanaland, and the graves in its vicinity. Here Dr. Livingstone lived as a missionary among the Bechuanas, before setting out upon his great journeys of exploration. With the aid of the native chief, Sechele, the ruins of the house have been fenced and protected by a shed, and the site is to be kept clear of jungle and placed under the care of the headman of a neighboring village.

American Manufacturers to Produce Filter Paper.—The Bureau of Standards has interested several American manufacturers in the problem of making filter papers of a suitable quality to replace those hitherto imported from abroad. Such papers are used in all chemical laboratories and in large quantities in industrial work for filtering out fine suspended particles from a liquid. They must have a very low percentage of ash and a rapid rate of filtering, and must be free from certain constituents. The chemical treatment after the manufacture of the paper itself is especially important, and the Bureau has been experimenting upon this phase of the question.

A Second Piltdown Skull?—In a recent communication to the Geological Society of London, Dr. A. Smith Woodward reported that in the winter of 1915 the late Mr. Charles Dawson, the discoverer of the Piltdown skull, found in a ploughed field about a mile from the place of the original discovery, the inner supraorbital part of a frontal bone, the middle of an occipital bone, and a left lower first molar tooth. The first and third of these fragments Dr. Woodward refers with confidence to *Eoanthropus dawsoni* the Piltdown species of mankind. It is uncertain whether they represent a single individual.

Alternation in Fruit-bearing.—The Fifteenth Report of the Woburn (England) Experimental Fruit Farm discusses the popular idea that fruit trees tend to bear heavily and lightly in alternate seasons. This idea is often made the basis of a recommendation to thin a heavy crop borne one year, in order to obtain a better crop the next year. The authors of the report believe, however, that the tendency toward alternate cropping is very feeble, and that there is, at the same time, an equally powerful tendency toward uniform cropping, so far as the innate qualities of the tree are concerned; the chief factor in determining good or bad bearing being probably the weather, especially the occurrence of spring frosts.

Fossil Man in South Africa.—What is said to be, with the exception of the Piltdown skull, the most interesting early human skull known, was found by a South African farmer in 1913, while digging a trench through surface laterite at Boskop, near Potchefstroom, Transvaal. The remains are now in the Port Elizabeth Museum. According to Dr. Robert Broom, who has just communicated the results of his studies on this subject to the American Museum of Natural History, New York, the Boskop skull is the type of a hitherto unknown species of man, which he proposes to call *Homo capensis*. He regards it as intermediate between the "dawn man," *Eoanthropus dawsoni*, and the early African type of man as represented by the Crô-Magnon man and the ancestral negroid type. The Australian native is regarded as possibly also derived from a similar early type. and Dr. Broom thinks that even the Neanderthal man be derived from the same type. The Boskop skull is not complete. It is represented by the nearly perfect frontals and parietals with part of the occipital, the nearly perfect right temporal, and the greater part of the horizontal ramus of the left mandible. The skull is of great length, the bones are extremely thick, and the cranial capacity is enormous. Dr. Broom connects these remains with the abundance of huge *bouchers*, or primitive skinning knives, which have been found in surface deposits in South Africa, and is inclined to believe that the Boskop man was contemporaneous with the South African mastodon.

Astronomy

Schaumasse's Comet.—According to a recent bulletin from Harvard College Observatory Schaumasse's comet was observed by Shane at the Lick Observatory on April 29, 9743 G.M.T. in R.A. 23 h. 9 m. 38.3 s. Dec. +12° 50′ 57″. The comet was visible in a small telescope.

Radial Velocities.—The last annual report of the Mount Wilson Observatory records the determination during the past year of the radial velocities (*i. e.*, motion in the line of sight, as measured with the spectroscope) of 141 stars, based on three or more photographic plates each. Especially remarkable is the double star A.Oe. 14,318, the components of which, 5 minutes apart, have the same proper motion, parallax and radial velocity. This system moves in space at a speed of 580 kilometers (360 miles) per second

Photographs of the Milky Way.—Harvard College Observatory has just published, as Volume 80, Part 4, of its Annals, a series of nine beautiful photographs of the northern Milky Way, by Prof. Bailey. These are a companion series to the nine photographs of the southern Milky Way published as Volume 72, Part 3. All the pictures of both series were taken with the same instrument and with approximately the same exposure. In each case the exposures extended through several nights, and amounted to from 16 to more than 22 hours. The photographers were taken with a Cooke lens of about 1½ inches aperture, having a focal length of 13 inches. Collectively they present a remarkably detailed picture of the whole Milky Way.

Some Achievements of Harvard College Observatory, enumerated in the last annual report of that institution, include the classification of 228,000 stars according to spectral types; more than two million measures of the visual brightness of stars; the discovery of about three-fourths of the variable stars known to science; and much work in the determination of photographic stellar magnitudes. The classification of stellar spectra and the scale of magnitudes worked out at this observatory have been adopted as the standard for the world. Harvard's photographic "sky patrol," kept without interruption at Cambridge, Mass., and Arequipa, Peru, gives us a complete history of the stars down to the 11th magnitude for the past 25 years, written by the stars themselves on a quarter of a million plates. The weight of these photographs amounts to 120 tons.

Mysterious Brightness of a Winter Night.—English and French astronomers report that the night of December 23d-24th, 1916, instead of being one of the darkest of the year, as it should have been in view of its proximity to the winter solstice, was brighter than the nights of midsummer. Although moonless, the brightness of the night was almost equal to that occurring with a moon at the quarter. M. Touchet, assistant secretary of the Astronomical Society of France, states at Viroflay (Seine-et-Oise), at 10:30 P. M., he could read newspaper headings and other large type down to about 18-point, out of doors, where there was no artificial light, on account of the scarcity of coal. At 5:10 A. M. of the 24th all details of the landscape were visible, giving the impression of dawn. M. Félix de Roy, the Belgian astronomer, now in England, says that at Thornton, Surrey, the brightness of the sky obscured the fainter stars and the Milky Way, as moonlight does, but this was true only of naked-eye observations; through the telescope stars could be seen as readily as on ordinary moonless nights. Reports differ as to the presence of an aurora.

Photographic Determination of Stellar Parallax.—Data concerning the distances of the stars are obviously of the utmost importance in the study of the structure of the universe, and such data have heretofore been obtained only by the slow and tedious measurements of apparent displacement, or parallax, due to the earth's annual motion. The total number of stars whose parallax has been measured is still very small. Hence great interest attaches to a new and rapid method of method of measuring stellar distances, devised at Mount Wilson Observatory. This is based upon the discovery of a numerical relationship between the absolute magnitudes of stars and the relative intensities of certain lines of their spectra. It depends upon existing methods of parallax measurement, but when the relation to the latter has once been established, it becomes possible to determine a star's distance from a photograph of its spectrum, by means of a few simple measurements and calculations. Comparisons of parallaxes thus obtained with the measured parallaxes of 124 stars showed an average deviation of only 0.025 second. The only discrepancy exceeding 0.1 second was in the case of a star whose parallax had been measured by only a single observer. The spectroscopic method appears to give its most accurate results for stars of types K and M. It is of little value for stars with types earlier than F5. This method has afforded, among other things, interesting confirmation of the conclusions of Russell and Hertzsprung regarding the existence of giant and dwarf stars.

"The 12½-Minute Cafeteria"

How Rations Are Dealt Out to the Recruits at the Newport Naval Training Station

THE first 24 hours of a United States Navy recruit's life contains a full score of new experiences and impressions, none of which is more interesting or important than the bugler's call for mess. No matter how difficult the lessons in seamanship, deep sea navigation and splicing rope, it only takes a matter of hours to recognize and respond to mess call.

To the recruit, mess call means nothing more nor less than a full allotment of rations: to the chief steward of the commissary it has a totally different significance. It means to the chief steward that, three minutes after the call is sounded, 1800 able-bodied seamen are going to file by his four tables in marching order. It means his 20 commissary helpers are going to serve these 1,800 seamen, and further that it will take exactly 12½ minutes to complete the task of serving.

At 6.10 P.M. the bugler of Barracks B sounds the welcome notes: outside the barracks 1,800 sailors take their positions in squad formation. At the same time, in the "12½-minute cafeteria" there are 21 men, and four long tables, empty except for huge piles of tin plates, bowls and knives, forks and spoons, arranged at the near end of each table. From the chief steward comes the command: "Draw Meat"—one man from each table goes to the galley and "draws" a double-sized dish pan of pork chops, then the command: "Draw Spuds" at which, another helper from each table runs to the galley for boiled potatoes and returns to his respective place next to the pork chop distributor. In like manner, gravy, bread and tapioca pudding are drawn and put in place. This takes three minutes, at the end of which time the tables and men stand ready for the march of the 1,800.

From the door to the tables the space is roped off in four lanes, each lane having its own table at the farther end. Through these four lanes file the sailors, already in squad formation, four abreast. The familiar lockstep is often voluntarily used to economize space.

As the sailor approaches the table, the first thing he provides himself with is the necessary tin apparatus, the plate in his right hand and the bowl in the other. Knife, fork and spoon are stowed away under the plate. Then he moves on to the first helper and receives his pork chop and to the second helper for potatoes. His next stops are before the gravy and bread providers. Finally he reaches the end man with a full plate, and here the empty bowl is happily transformed to a heaping mass of tapioca pudding. This procession moves with clocklike precision, the only hitch being an occasional argument over the individual need of two spuds or how much smaller your pork chop is compared to the next man's. The only place where arguments are favorably settled is the bread sector. When the last of the 1,800 passes the tapioca pan, 12½ minutes by clock count have elapsed. Men leave the commissary room thus provided and get cups of coffee on the ground floor of the barracks.

There are six messes: Breakfast at 6.15 and 8.15; dinner at 11.15 and 1.15; and supper at 4.15 and 6.15. The two-hour interval between messes is necessary for the galley and servers to prepare the second mess of the same meal. In preparing the menu given some 2,100 loin pork chops were cut, 1,050 loaves of bread baked and five huge tubs of spuds. With this cafeteria system 3,500 rations can be served—rations that would obviously be of little interest to the hollandaise epicurean, but rations which account for the brawn and muscle needed for the United States Navy to do its present world task.

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The chief steward (in dark uniform) and his corps of assistants, most of them recruits

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College men at work in the bakery

New Method of Increasing the Yield of Wheat

THE world-wide deficit in the wheat crop, coupled with the increased demand that recently sent the price soaring above the $2.00 mark, that half a decade ago would have seemed fabulous, lends peculiar value to the report of certain experiments made in 1915 and 1916 by Prof. Devaux of the Faculty of Sciences at Bordeaux. The results of these experiments were recently laid before the Academy of Agriculture. Professor Devaux conceived the idea that winter wheat might get a better start and therefore produce a better yield if it were planted several weeks in advance of the customary season. Consequently he made a sowing in August, 1915. The grain promptly sprouted and showed astonishing vigor, many of the hills containing 25, 30, 35 or even 40 stalks. Some of these stalks were exceptionally large, a number attaining the height of from 1.75 to 1.8 meters (5.6 to 5.8 feet). The harvest was likewise uncommonly large, exceeding the usual yield by about one kilogram per square meter.

Prof. Devaux is convinced that wheat is generally sowed too late, and that farmers would find it to their advantage to advance the time of sowing by one or even two months.

The Current Supplement

ALTHOUGH the study of agricultural problems has been carried on for centuries there are still many facts relating to the soil, its constituents and the chemical reactions that take place therein that are not understood, much of which information would undoubtedly be of inestimable value today when the world is facing the possibility of a serious shortage of food. A question of practical importance in this direction is in regard to the rôle played by calcium in the soil and in plants. In the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2158, for May 12th, will be found a paper on *The Physiological Rôle of Calcium in Plants* that deals with some investigations that will be of value to many students of agriculture. *The Jacoons* describes a curious aboriginal race that dwells in the Malay peninsula, and there are photographs showing the character of these people. *Modern Ideas of Cosmogony* is an able review of the most important hypotheses relating to the problem. It is accompanied by an excellent photograph. *The Marseilles-Rhone Canal* gives many facts of interest connected with a great engineering undertaking in France. It is accompanied by a map showing the route of the canal, and a section of the great tunnel that had to be constructed. *The Shortage of Ships* discusses briefly an important contingency that is affecting the entire world, and has a vital bearing on the results of the great war. It is illustrated by a number of interesting photographs. *Cavitation* is a study of an important engineering problem connected with the propulsion of ships and is accompanied by two diagrams. *Silent Warfare* reviews various endeavors by inventors to suppress the noise and flash from guns in order that their location may not be disclosed; and the article is illustrated by a large number of sketches. The valuable paper on *Precision in Chemical Weighing* is concluded in this issue. *Chemical Control in the Leather Industry* discusses questions of importance connected with the tanning of leather. There are a number of shorter articles of general interest.

The line of march through the "cafeteria"

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A group of yeomen at their noon-day meal

Making the Railroad Car Safer

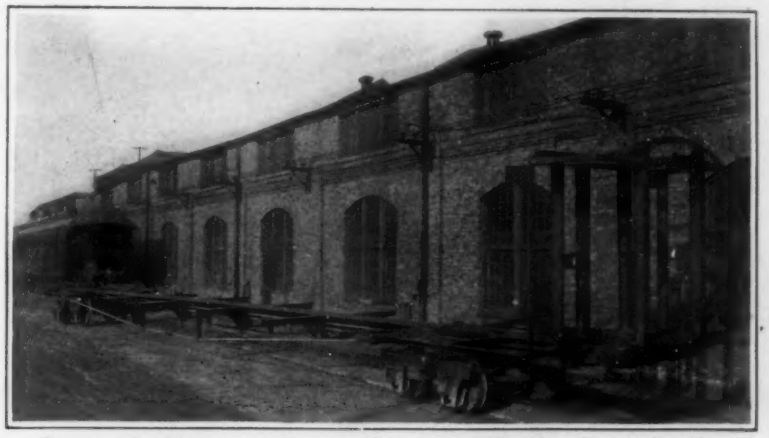
The Eighth Award of the Scientific American Medal for Safety Devices

By Arthur H. Young, Director, The American Museum of Safety

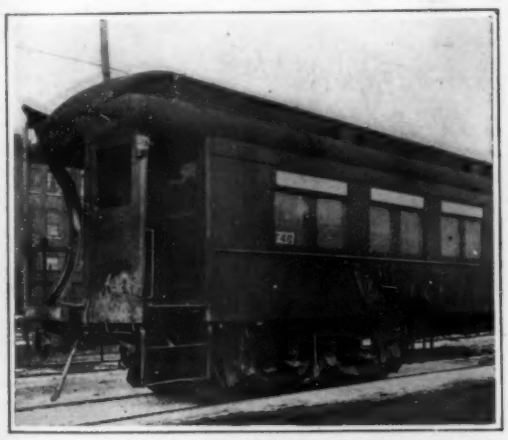
NINE years ago The American Museum of Safety was formed by a small group of men interested in safeguarding life and limb from industrial and other accidents. For the greater part, the trustees were editors of technical publications, which supported the new movement with great enthusiasm. That the work of the museum has been eminently successful is evidenced by the fact that today there are several museums of safety throughout the United States. Furthermore, the great number of "Safety First" societies, committees, and other organizations, which have for their object the elimination of carelessness and faulty equipment as a means of preventing accident, may be said to be a direct result of the inspiration received from the work of The American Museum of Safety.

Early in the history of the museum it was felt that some encouragement should be offered to corporations and individuals to invent and install safety devices, as well as to look after the welfare of employees. The SCIENTIFIC AMERICAN was the first to offer a medal for this purpose, and it has now been awarded eight times for the most efficient device invented within three years of the award and exhibited at the Museum. These awards have been as follows: 1908.—The Rich Marine Fire Extinguisher Company; 1909.—The Patent Scaffolding Company; 1910.—The Norton Company; 1912.—The Draeger Oxygen Equipment Company, for the Pulmotor; 1913.—The Welin Marine Equipment Company; 1914.—The Shurloc Elevator Company, Inc.; 1916.—Elmer A. Sperry and the Sperry Gyroscope Company.

The SCIENTIFIC AMERICAN medal was awarded in 1917 to the Pullman Company of Chicago for the invention of their Vice-President, Mr. Richmond Dean. The dangers of collision and telescoping were referred to by Dr. Frederic R. Hutton, who has always made the speech at the award of the medals at The American Museum of Safety. The occasion was an informal luncheon, which was held at Delmonico's, New York city, on April 25th. We will now give a brief non-technical description of the device which was awarded the SCIENTIFIC AMERICAN medal.

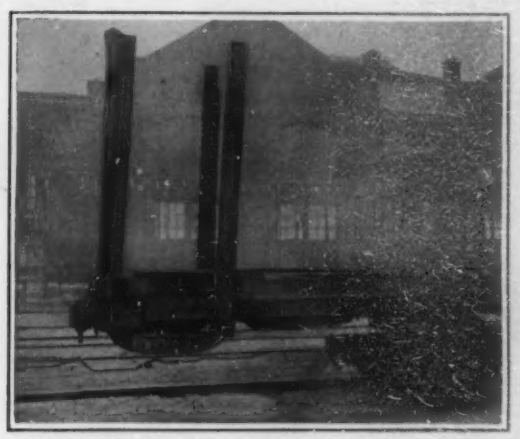


Framework of the new end construction for cars, showing the relationship between the U-shaped members and other components



After a collision: How the U-shaped members bend and take up the shock

The Scientific American medal for safety devices, awarded to the Pullman Company of Chicago



The U-shaped members of the new end construction as applied to steel cars

From a careful study of accidents and collisions resulting in the wrecking of passenger trains, it has become apparent that a much more substantial end construction for both wood and steel cars is necessary in order better to withstand the shearing effect that a heavy steel underframe of one car has upon the superstructure of another when this underframe laps over that of a car ahead in a collision. As a means to reduce to a considerable degree, if not wholly eliminate, the destructive effects in such instances, a new type of end construction has been developed and is now being applied to all modern Pullman equipment in combination with a cast-steel platform and double body bolster and steel underframe.

Having discovered that the constructions of framing of the cars may be modified so as to afford greater safety to passengers and to reduce to a minimum the damage done to the cars, Mr. Dean proceeded to develop the present form of end construction. It had previously been supposed that to enable cars, more particularly those of the modern steel or partial steel construction, to withstand best the shocks of collision, the car underframes should be made of comparatively great strength and rigidity so that the buffs and blows of the collisions would be transmitted through the longitudinal beams or members of the underframe, and in this way prevent damage to the body of the car. Mr. Dean found, however, that this style of construction could be improved upon, because of the fact that when the impact occurs the underframe of one car has a tendency to mount and override that of the next car, shearing off or otherwise seriously injuring the superstructure or car body, as already mentioned. In other words, he discovered that unduly strong underframes, instead of affording the presumed advantage of safety to the passengers and of preserving the cars from injury, might, at least in some instances, contribute to the damage of the latter. Furthermore, if the force of the collision is sufficient to cause such overriding underframe to break down the end wall of the car against which it is thrust, then the further travel of the frame is not materially opposed, due to the fact that the car body walls will spread outwardly and admit the advancing car between them.

It has been the object of Mr. Dean's invention to overcome these and other difficulties. In substance his invention involves the plan of preventing the collapse or battering down of the car body and wall, because, as has been explained, if this occurs the resistance to the advance of the crushing car is materially decreased. His plan, then, is to remove the surplus strength from the underframe and so to construct and strengthen the vestibule that the latter will act as a cushion to absorb and dissipate the force of impact. The intention has not been to increase the weight of the car, but rather to redistribute the weight of the various elements in the car construction and thereby more nearly equalize the strengths of the various parts.

The principal feature of the new end design is an I-beam, heavy in section, bent in the form of a U, the legs of which extend upward through an aperture in the platform casting, the upper ends of these I-beams being thoroughly anchored in an end superstructure made up of structural shapes. Two of these U-beams are applied at each end of the car in the manner shown, one leg forming a door post at the entrance of the car, while the other forms a door post for the opening between the cars at the platform end wall. The U-shaped members are made from one continuous I-beam instead of being made up of riveted sections; thus, this form of construction obviously makes for great strength and eliminates any possibility of the failing of the riveted joints.

With Mr. Dean's end construction it is readily seen that in case of collision, should one underframe override that of the next car, its progress will first be obstructed by the legs of the U-beams at the buffer sill, which, as they bend, will tend to lift the whole car body, thereby giving greater resistance to the farther advance of the overriding car. If these should fail there would still be the second leg of the U-shaped member, together with the strengthened car end, to retard further the progress of the overriding underframe.

From a study of the accompanying illustrations it will be noted that this construction is most substantial and efficient and yet comparatively simple. It has been the purpose throughout the construction to reduce the number of riveted joints to the minimum. The new car end wall is securely fastened to the cast steel combined platform and double body bolster and is made up of Z-bar end posts extending to the top of the roof and secured to the other parts of the car frame in a substantial manner. The outer faces of these posts are riveted to a channel deck end sill above the doorway, which is bowed to accommodate the rear legs of the heavy U-shaped I-beams. The remainder of the vestibule is constructed to harmonize with the new features.

The Travelers' Insurance Company's Gold Medal was awarded to The Commonwealth Steel Company of St. Louis; the Louis Livingston Seaman Gold Medal was awarded to the Julius King Optical Company of New York; the E. H. Harriman Memorial Medals were awarded to: The Gold Medal to The Alabama Great Southern Railway; the Silver Replica to the Illinois Division of The Illinois Central Railway; the Bronze Replica to Mr. James A. McCrea, General Manager of The Long Island Railroad Company. The Anthony N. Brady Memorial Medals were awarded to the American electric railway accomplishing most in the preceding year for the safety and health of its employees and passengers and were as follows: The Gold Medal to The Connecticut Company, New Haven, Conn., the Silver Replica to Seth W. Baldwin, Assistant Attorney in charge of Claim Department, the Bronze Replica to Mr. Walter J. Flickinger, Secretary to the President, all of the same company.

The work of The American Museum of Safety is progressing favorably, and there have been many calls upon it in the present crisis.

Lengthening the Life of a Chain

WHEN a chain is used on a pulley for lifting a heavy load the grinding noise produced by the friction of the metal is very disagreeable and trying, and no amount of oiling does away with it. This harsh noise may be prevented, however, by the simple expedient of twisting a hempen rope of suitable size in and out of the links of the chain. We learn from *Je Sais Tout* that the British Admiralty has conducted exact experiments also, to determine the increased "life" of the chain secured by thus diminishing the friction. The term of use of the chain thus protected is no less than 70 per cent longer than that of the bare chains. Allowing for the initial cost of the rope and calculating its time of service, it is found that a net saving is secured of from one fifth to one third the value of the new chain.

Strategic Moves of the War—May 3rd, 1917

By Our Military Expert

IN last week's review attention was called to the methods being employed by the Entente Allies to wear down the Germans by attacking first at one end of their lines and then at the other; these methods appear to be continued. Rather than attempt to break through the German lines at one blow—which, even, if successful, would be most costly in men and materiel—the present plan appears rather to be a strong attack, after artillery preparation, a re-arrangement and consolidation of gains and then a new attack in the same manner. In this way the former great losses in the bloody battles around Ypres, Loos and in the Champagne region would be avoided.

To understand thoroughly the new operations now being carried out after the first British advance and consolidation, it must be remembered that, when the first advance began this year, the British overran and pierced the German permanent system, from the northern end of the Vimy ridge to the vicinity of Croisilles on a front of 12 miles and to a depth of four or four and a half miles. They also gained a foothold in several places on a reserve line behind the permanent one, which line was known as the "Oppy line." This began at Lens and after passing through the town of that name, took in a number of villages—among them Arleux, Gavrelle, Fampoux, Roeux, Monchy and Guémappe—thence on to Croisilles. While a number of these villages, Monchy especially, were captured in the first rush, portions of the line continued to be held by the Germans and their possession is still hotly contested by both sides.

The latest news gives the storming and capture by the British on April 28th of Arleux, one of the northern portions of the line, and a drive forward on a front of ten miles clear down to the right bank of the Scarpe River. The capture of Oppy itself is also reported but not yet confirmed as the description of the fighting there states that—"wave on wave of German attackers move forward only to be mowed down under machine gun and rifle fire." Below the Scarpe heavy fighting is reported as far south as Monchy; on the north, British gains are reported all the way to the Acheville-Vimy road almost on the outskirts of Lens.

Arleux is only nine miles from Douai; in a strategic point of view, it menaces the trench systems of the northern end of the so-called Drocourt-Quéant switch line. According to rumors and general belief, the Germans are constructing or have constructed such a line of defense beginning at Hill 70 southeast of Loos and running south through Drocourt to Quéant, then joining the main line of defense. This switch line is generally parallel to the Oppy line and about three miles east of it. Everything points to the fact that the line is not yet completed and that the strong German counter-attacks are for the purpose of delaying their opponents until it is ready. Otherwise it is not possible to explain why such costly efforts should be made and should be so long continued with terrible loss of life. Monchy and Roeux are the keys of the Oppy lines; being held by the British as commanding positions, they have been the special object of these counter-attacks, which so far have been futile.

The direct object of the present British offensive movements is the breaking of the Drocourt-Quéant line; reports have led to the belief that the Germans were evacuating Lens but it is also stated that Marshal Hindenburg personally gave orders for its continued occupation. The risks of doing so must be known to him, for the position is a salient thrusting into the British lines; the sides can be crushed in or the town pocketed so that, if it is not finally hurriedly abandoned, the capture of the troops and guns within its area is a certainty. There must therefore be strong reasons for its retention. The main objective of the present British advance is of course Douai, some eight or nine miles east of their present front. They are moving toward that city along both banks of the Scarpe River that flows by both Arras and Douai. As they now hold the commanding heights that overlook the country toward Douai, no serious obstacle ought to be encountered over the intervening practically level terrain until the outskirts of the city are reached—certainly there is no position like that of Vimy hill which was so successfully stormed. However, the first forward movement was made with the assistance of secretly arranged and very heavy barrage fire; it was therefore not very costly in human life. But any assaults on new lines encountered in the forward movements will not have so efficient a support; the true test of strength will therefore come at that time.

If the Drocourt-Quéant line does not hold the British long enough to ensure the construction of other defenses nearer Douai, then the Germans will lose that city and must abandon their positions in France from Lille to the Meuse at Mézières and to the hills around Verdun. In other words, Douai on the north for the British and Laon on the south for the French are closely inter-related as regards their effects on the present campaign. If the French take the latter city, the Germans must go back to the Meuse; if the British take Douai, the Germans must withdraw to the frontier.

From the terrific and bloody fighting now taking place as the British move forward from Vimy and Arras toward Douai, it would seem that the maximum of German resistance can be expected here; a second defeat like that of the first battle of Arras would show that the German morale and German fighting power had so diminished that they might in the end lead to a collapse and an acknowledgment of defeat. The constant employment of massed formations for attack, as mentioned so often in press dispatches, must cause enormous losses of men that cannot be replaced; such formations can be described as only reckless unless the German leaders are suspicious of the staying qualities of their reserves if allowed too much freedom on the fighting line, and they therefore employ such formations as a means of prompt and secure control.

To the south, in the direction of Cambrai and St. Quentin, while some fighting is reported, nothing of serious import appears to have taken place. By the capture of Vendhuile mentioned in the last review and of all the high ground between it and the wood and villages of Havricourt, Trescault and Gonnelieu, the valley of the Scheldt can be cleared up to the canal and river; the town of Marcoing on the river can also be taken. This last is only four miles from Cambrai and, once in British hands, the railroads entering the town both from the east and north will be within cannon range. It will not be so easy to go beyond Marcoing, for the river is an obstacle of great defensive strength. The British have made notable strides since the advance began; despite all efforts of the Germans to stop them, the latter have been driven back at all points and the end is not yet. Whether their military strength will soon be so sapped and weakened that an extended withdrawal through Belgium to the Rhine may be looked for, is taking many chances on a guess. That they are steadily being driven back and losing cannot be gainsaid. But predictions as to a military and economic collapse would not be safe at the present time. There are however signs now that the Germans' munition supply is seriously crippled and that it has been found necessary to use worn out guns.

From Sinai Peninsula to Jerusalem

Railroads shown by crossed lines

Arras battle lines on May 3rd, 1917

On the Aisne front the French have apparently been consolidating their positions preparatory to making another advance—possibly as soon as the British, hammering at the other end of the line, have also had to stop to reorganize their own lines. Artillery fighting is reported as active in the vicinity of Cerny and Craonne west of Rheims, and German counter-attacks are reported in the vicinity of Mont Haut, where the point of the French wedge that is being driven into the German lines approaches the Nauroy-Moronvillers road. This wedge is the result of careful preparation and was gained by catching the Germans off their guard.

Little has been heard recently of operations on the Russian front and he would be a brave man, indeed, who would try to solve the present riddle of the situation in that country. Nothing is known that would make it safe even to hazard a guess. There can be no doubt that the Allies will all be benefitted by anything that Russia can do as a military power; but just now all its natural strength must be given up to overcoming the socialistic and anarchistic tendencies fostered by German influence and German money. But, if the powers that rule can keep the army and navy loyal, Russia can maintain her lines on her western front and can thus hold there most of the Austrian army and many portions of the German strength that could be used to such great advantage just now on the western area. Even if her troops make no advance but remain in their trenches, they not only hold troops in the opposing armies, but also maintain the blockade of Germany as regards food, thus continuing the work of starvation. If, on the other hand, she should make a separate peace as has been so strongly urged, her food supplies would at once go into Germany; the latter's troops on the Russian borders would go at once either to the Western front, or to help the Austrians against Italy, or against the Saloniki army.

As regards the Mesopotamian campaign, the Turks, according to an official bulletin, are intrenching on the Tigris about fifteen miles north of Samara, *i. e.*, about ninety miles north of Bagdad. These troops (the 18th Army Corps) were heavily engaged in the recent fighting in the vicinity of Samara and their loss as a result has been placed at 4,000 men. The 13th Army Corps that was driven off to the east had been busy for several days fortifying a position on both banks of the Shatt-el-Adhem, a tributary of the Tigris that rises back of the Jebel Hamrin hills. Here they were surprised by the British on April 30th, were badly defeated, and were forced to retreat into the hills, where they have taken refuge. The British commander reports the capture of a number of officers, men and much materiel; he also mentions the continued pursuit by his cavalry of the retreating enemy. However, an advance on the Tigris to the north will now be all the more difficult as the northern end of the Bagdad railway has been probably reached at that place. If the road has been built farther north in the direction of Mosul or if it has been actually completed all the way through Mosul to Aleppo, then the transportation problem becomes for the British a relatively simple matter. With the Russians joining hands with the British on the Diala and Shatt-el-Adhem Rivers on the south and with the Russian advance upon Mosul from Persia on the north, there seems little chance of the Turkish armies opposing them to do anything else than surrender in the end.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Safety of Ships at Sea

To the Editor of the SCIENTIFIC AMERICAN:

Permit me to supplement the remarks of the *London Times* expert upon this subject, which you carry in your issue of December 30th.

Confining his attention primarily to the advisability of proper subdivision by bulkheads, it appears that this gentleman was concerned in the greatest degree with the large passenger vessel. Although both the "Titanic" and the "Lusitania" were bulkheaded according to the very latest procedure, I would not say a word in deprecation of such construction, where practicable; indeed I have always given the forepeak and engine-room bulkheads the greatest attention. But it is not practicable to bulkhead a cargo steamer so as to render her invulnerable to a blow in a vital part, so I may dismiss this feature and touch upon another element of danger.

Forty years ago salt water vessels were fitted with coamings around the hatches, skylights and companions not more than a foot high and a quarter of an inch thick; and indeed, superstructures were hardly more substantial. In the year 1881 no fewer than 1,387 British vessels, aggregating over 385,000 tons, were lost at sea. Most of these craft were of the "well deck" type, in which the break of the main deck was inadequately reinforced or compensated. While a considerable number of the losses mentioned were doubtless due to this unfortunate feature of construction, authentic reports of many disasters make it practically certain that a large majority were attributable to low and flimsy coamings.

American flush decked vessels are not subject to vital stresses at their decks and topsides; if their hatches are strong and well secured, with all coamings of ample height, the risk of foundering is very slight. A small vessel, however, has greater need of deep and strong coamings than a larger ship; a good rule for safety is that the depth of coamings should increase inversely as the molded depth.

Twenty years ago 6-inch coamings were common, especially around the boiler and engine houses, companions and skylights. Even today we have quantities of vessels thus equipped, with their wells protected by houses weakly connected and of the flimsiest construction. Attention to these details will form a larger contribution to safety at sea than any practicable subdivision by bulkheads, or fine percentage additions to surplus buoyancy, as arrived at under the influence of well-decker ratios in the formulation of freeboard tables.

JOSEPH R. OLDHAM.

Cleveland, Ohio.

The Farmer Can Win the War

To the Editor of the SCIENTIFIC AMERICAN:

In this great time, when every citizen must do his part, the President has made his chief appeal to the men who live on the land. He is right in doing so, for the safety of our country just now is in the hands of our farmers. What I mean is not merely our safety and the safety of our allies in the matter of food. I mean that the safety of the United States against foreign invasion hangs on the decision of the farmers of the 48 States.

The two great weapons in this war are arms and starvation. The war against German arms will be won or lost in France—the war against starvation will be won or lost in America. The Kaiser cannot whip the French and English armies and the English navy while England has food. But it is still possible that the German submarines may be able to keep food enough from reaching England to starve her into submission.

If the submarines win, the first item in the Kaiser's terms of peace will be the English fleet. With the English fleet in his possession, the Kaiser will be master of the world.

What will happen to us then? Every man who stops to think knows the answer. We shall have money, food, labor, land—everything that is desirable in the world except the power to protect what we have. Experts estimate that it will take us nine months to get ready to meet a German army of even 150,000 men, with modern artillery. Under such circumstances, would the Germans treat us better than they have already treated Belgium and France?

Even if the armies of our allies should crush the German military power this summer, before the shortage of food can reach the point of want, the world would still need vast quantities of American food. But if they do not, only one course can make us safe, and that is to grow food enough on our farms for ourselves and our allies, and to put ships enough on the sea to carry the food, in spite of the submarines, to the men who are fighting our fight.

If the war lasts beyond this summer, it will be the American farmer who will win or lose the war; who will overcome militarism and autocracy, or allow them to spread and control the world, ourselves included.

This is no fanciful picture, but sober fact. Many a man will make light of it until he comes to think it over, but I venture to say that few will treat it lightly after careful thought. It is no more impossible than the great war itself appeared to be, only a few days before it began.

It is true that we can greatly increase the available food supply out of grain now used in making liquors, and by reducing household waste. But when these two things are done, and done thoroughly, they will not be enough. The final decision will still rest in the hands of the men who raise our food in the first place.

The clear duty of the nation is to guarantee the farmers a fair price for their crops when grown, and a reasonable supply of labor at harvest. The clear duty of the farmer is to raise food enough to win this war for democracy against Kaiserism.

No such responsibility has ever rested on any class of men since the world began as rests today on the farmers of America.

GIFFORD PINCHOT.

Milford, Pike Co., Pa.

Rumania and the U-Boat War

To the Editor of the SCIENTIFIC AMERICAN:

About the beginning of last September, Rumania entered the war. At that time, the Anglo-French forces were in command of the air on the Western Front. One of the German explanations was that they were unable to use all of their air-craft on account of lack of fuel, and for the same reason, it was claimed that many U-boats were being held in reserve, instead of being used.

Be that as it may, it is certain that October saw a sudden and very great increase in U-boat activity, and at about the same time German aviators began to contest the supremacy of the air with the Entente airmen. By that time also, the Rumanian campaign had developed to such an extent that the members of the German general staff were probably certain of the final outcome, as they were naturally in possession of information concerning the state of affairs on that front, that others could not possess.

Certain of securing the Rumanian oil fields in a short time, the Germans may well have drawn on their reserve stores of oil immediately, in order to begin active aerial and submarine campaigns.

Frequent newspaper reports, which may or may not be founded on fact, seem to indicate that during May, the Germans expect to put some seven hundred submarines in commission, in addition to the two or three hundred they are believed to be using now. It is claimed that the merchant submarine, the "Deutschland," was built in five or six months. An editorial in the SCIENTIFIC AMERICAN of April 7th, stated that six months would probably be time enough to construct a boat, and that if the Germans chose, they probably could have about a thousand standardized U-boats under construction at one time. From October to May, inclusive, is eight months.

These facts, if such they be, seem to indicate that Rumania's entrance into the war was the direct cause of our being involved, and may also show that unrestricted U-boat warfare on a tremendous scale may not be evidence of desperation, but may be founded on the belief that the construction of 2,000 U-boats a year will bring the war to a speedy end, if used to greatest effect.

X. Y.

Corpus Christi, Texas.

The Chain-Shot

To the Editor of the SCIENTIFIC AMERICAN:

As modern wars are won by superiority of ordnance, explosives and projectiles, when enemies are equal in the production of munitions, the event may be decided by invention or even a readaptation of old devices.

I have been interested in reading the communication of Mr. Robert G. Pilkington of Chicago, published in the SCIENTIFIC AMERICAN of March 24th, suggesting a revival and modern adaptation of the chain shot, especially as applied to the problem of reducing the barbed wire entanglements, now so important a part of an intrenched enemy's defenses.

Something in the way of a contribution toward producing effects indicated by Mr. Pilkington's communication appears to have been provided in the offering of a New York City inventor, Mr. Julius Wodiska, who has invented a double-barrelled cannon designed to expel two projectiles united by a chain of desired length. A patent was issued on this invention December 21st, 1915; serial number, 1,165,053.

Features of the Wodiska gun include slight divergence of the barrels at the muzzles; breech-loading, adapted to the use of modern military powders or to compressed air, and, if employed against air-craft, the gun can be alined for aiming at any angle, from level to vertical, the muzzles describing a quadrant of the azimuth circle. Provision is also made for the rotation of the twin barrels so that they can be discharged side by side or one above the other; through this facility the chained missiles can be sent broadside at an air-craft whether it be sailing "on an even keel" or climbing or plunging.

In theory, at least, the chained missiles would be effective against massed troops, barbed wire barricades, air-craft, and, possibly, to blind a naval submersible craft by raking off its periscope.

The details of the invention seem to have anticipated objections likely to be commonly raised as to the probability of breaking or entangling the connecting chain.

The inventor's vision, he says, was suggested by consideration of the bola—two or more iron spheres attached by short thongs to the end of a raw-hide rope—the characteristic weapon used in hunting pumas or other wild animals and wild cattle by the gauchos of the Argentine pampas.

ALLEN S. WILLIAMS.

New York, N. Y.

Another Remedy for Exhaust Gases

To the Editor of the SCIENTIFIC AMERICAN:

A recent issue of the SCIENTIFIC AMERICAN contained a statement by an automobile owner that he connected a rubber hose to the exhaust of his car to carry the dangerous gases out of the garage.

Reading this article suggested that my plan the past winter might possibly be of interest:

I first bored a hole about 2 $\frac{3}{16}$ inches in diameter through a lower panel of my garage door, just back of the car and about the height of the exhaust pipe under the car. On the inside over this hole I put a wooden shutter with a screw at one end so that it would open and shut. This I shellacked to protect against warping by the weather. I then used a length of 2$\frac{1}{2}$ inches galvanized drain pipe long enough to project from the exhaust pipe through the hole in the door several inches. A little pressure of the pipe against the exhaust nozzle will shape the pipe nicely.

With this arrangement, I have run the car for hours at a time inside of the garage with all doors and windows tightly closed without any bad effects and with only slight evidence of the exhaust. When through running the engine the pipe is simply taken off and put away, and the little shutter in the door closed until the next time to use it.

E. L. BRANSON.

Battle Creek, Mich.

Comparative Vulnerability of Geared and Electric Drive

To the Editor of the SCIENTIFIC AMERICAN:

In the several communications you have recently published on our country's battle-cruisers and their drive, there has been one thing that has not been mentioned, so far as I know; that is, the vulnerability to the one-man attack.

In the gear drive there is the possibility of putting something in the gear case that might wear the parts or break the gears, but for one man to do this it would be necessary for him to unfasten some cover, which would require time and most likely he would be detected in the act.

Now as to the electric drive, what would be the effect of a few ounces of a strong corrosive acid on either the generator or motors?

Just a few years ago, if my memory serves me correctly, the city of St. Louis had part of her electric power plant put out of use by some miscreant pouring a little acid on one or more of their generators.

Of course the generators and motors of a battle-cruiser would be better protected and probably not so easily acted upon by an acid but I hardly believe their makers would claim that they would stand the acid test. Possibly sea-water would have the spy's desired effect.

Would not the gear drive offer a better opportunity of carrying spare parts that might be needed than the electric drive? Certainly the pinions of one set of turbines will not weigh as much or be as bulky as the rotating part of a generator, nor will the spur gear weigh as much or be as bulky as the rotating part of the motor.

CLINTON B. PIKE.

Birmingham, Ala.

Government Distribution of Fertilizers

To the Editor of the SCIENTIFIC AMERICAN:

Food production can be increased *quickly* only by more thorough fertilizing of existing tilled lands. With the present high price of fertilizer, the average farmer will not feed his lands *generously* and therefore maximum production will not be realized.

To avoid this evil, the government should buy up all stocks of fertilizer and distribute free to each farmer the amount and grade recommended by his county agent or agricultural expert. These agents are the official representatives of the Department of Agriculture and are therefore qualified to act as distributers and to check waste.

The Department of Agriculture can handle the whole matter if an appropriation is passed by Congress. Persons with influence must push the idea as the planting season is imminent.

PERCIVAL MOTT.

Norton, Mass.

Britain's Bid for the Control of the Air

How British Aircraft Production Has Kept Pace with the Demands of the War

By Lieut. G. L. Faulkner of the British Royal Flying Corps

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Representative types of the British air fleet, including fast and slow "tractors" and "pushers," and a scout-dirigible

FOR a half hour or more a British pilot and a German pilot maneuvered some ten thousand feet above the contending armies in France several weeks ago, engaged in a death struggle just as gallant knights of old. Aeroplanes were the mounts of these modern knights, and for lances they used machine guns; the lists were the limitless upper air, and the audience the thousands of soldiers in the trenches below, who paused for a few moments in their grim work to watch the aerial combatants, as they charged at each other and looped and nose-dived and stalled and back-slid and side-slipped and dropped as each took turns as the pursuer and the pursued. All the while they were accompanied by the rat-tat-tat chant of their machine guns pouring hundreds of bullets at elusive targets. Finally, when each pilot came to the conclusion that he had met his match and that further fighting would gain him nothing, he turned and made off for his hangar; evidently, the two pilots came to the conclusion at about the same time, and both were ready to concede the combat a drawn one.

If we eliminate the spectacular features of this aerial fight, which, after all, is typical of hundreds that have been fought on the Western front in Europe, as well as the high degree of skill displayed by the pilots, we arrive at a striking test of the modern fighting machine and the modern engine. For here we have two machines going through a half hour of the most serious and trying service any aircraft can be subjected to, and yet never for a moment does engine or plane fail to function. Here, then, is a concrete example of what the war has meant in the direction of better aeroplanes and more reliable engines.

FLYING a Vickers biplane a few weeks ago, E. A. Kelly of Montana, U. S. A., a captain in the Royal Flying Corps, climbed to a 10,000-foot altitude under eight minutes at Governors Island, and then flew over Manhattan Island at a speed of 136 miles-per-hour against the wind and 178 miles-per-hour with the wind. It was an astonished gathering of American military men who witnessed these feats executed on this representative British machine. How Britain has developed such aeroplanes for military service is told in this article by the author, a Canadian airman, who has now returned to France after spending some time in the United States. The facts given are those of the author, who has had ample opportunity to study the British machines at first hand. In a previous issue Lieut. Faulkner has told us something of the training of the British airmen, and in a subsequent issue he will tell us something of the fighting tactics of these airmen now flying over the embattled Allied and German troops on the Western front.

—EDITOR.

In the Days of the Sixty-Mile-An-Hour Aeroplanes

Machines used prior to the war were very slow and unreliable. The engines, too, were notoriously unreliable and did not develop sufficient power to take the aircraft to any great height, hence they were of little military value since good climbing power is absolutely essential to the pilot's safety. Take, for instance, the ante-bellum Bleriot: This machine of the monoplane type was employed to a great extent before the war. It developed a speed between fifty-five and sixty miles an hour, and a climbing speed—useless for present-day work—in proportion. This machine was soon found unsuitable for military operations, and was relegated to school service in which it has done very well indeed as a mount for teaching pilots how to land and how to get off the ground.

Another machine available before the war was the Model B Wright biplane, equipped with a low-powered engine driving two propellers by means of a chain transmission. With a speed of but 45 miles an hour, this type was positively useless in any wind; besides, it was in danger of stalling if the pilot attempted to make it climb rapidly. Its engine was unreliable, to say the least, and did not develop sufficient power to get the aircraft off the ground within the required period. However, the old Wright biplane has served to good purpose by training a large number of pilots at the

How Britain's women are "doing their bit" in the great war: Women artisans at work in a British aircraft factory, undertaking successfully various kinds of carpentering

beginning of the war to secure their Aero Club certificates, enabling them to cross over to the Continent and finish their training on the faster types of aeroplane.

As for engines, the situation was hardly better, for most types then in use had their relative merits and shortcomings—mostly shortcomings. One of the best engines available was the rotary engine first made by the Gnome Engine Company of Paris, France. This engine, known as the Gnome, developed 65 horse-power, although it was rated at 80. The great fault of this particular type was that the automatic inlet valve often broke down and resulted in a serious conflagration, which spread rapidly and in many cases meant death to the occupants, unless the pilot was able to make a prompt landing.

At the beginning of hostilities the A. V. Roe machine, the Bleriot and the Henry Farman were equipped with the Gnome rotary engine, and one of the results was that a number of Great Britain's best pilots were forced to land in German territory because of engine trouble. I myself have seen two officers burn to death on the aerodrome at Gosport, England, through Gnome engine failure.

It was in the details rather than in the general design that the early rotary engines were at fault, for of the many types of these engines now in use the greater part of them are perfectly safe, reliable and powerful, particularly the LeRhone, Clerget and Gnome Monosoupape types.

While it is true that previous to the war the rotary engine was favored in England and France, this may be largely attributed to the fact that no reliable stationary engines had yet made their appearance in those countries in any appreciable numbers. With the advent of the war, however, the stationary engine builders by a determined effort soon placed their products on an equal footing with the rotary engines, so that today we find both types used in about equal numbers. The rotary engine, being a lighter equipment, is now used almost exclusively for fast scouts and fast fighting machines—aircraft making a speed of from one hundred to one hundred and fifty-two miles an hour. The climbing power of a rotary engine is greater when used in a tractor than that of the stationary type. The latter, on the other hand, is employed on most battleplanes, reconnaissance machines, bombing planes and night flying machines, and for artillery-spotting work, because it is the most reliable power plant on long journeys over enemy territory, especially when it is of the water-cooled design as in the case of the Rolls-Royce and other heavy engines.

An Unmistakable Case of Aerial Unpreparedness

At the outbreak of the war the British air service was equipped with a diversified collection of old-fashioned engines and machines. The types already mentioned were used to a considerable extent, together with a number of Voisins and Maurice Farmans and Henry Farmans imported from France. Still, the military demand exceeded the supply available in Great Britain and France, hence the British government was obliged to place a large order with American companies for machines of the type they were then building. These machines, being generally unsuited to the conditions of military service, were purchased for training purposes only; but their engines were of good construction and were, therefore, taken out and used on the B E 2 C type of British aeroplane. It was found that a large percentage of the American machines sold to Great Britain were poorly manufactured and in one instance were responsible for the death of two officers at Beulagh, near Gosport, England, when the machine broke in two in the air. No fault was to be found with the material, which was, undoubtedly, the best obtainable; but the machines were not properly put together and had to be re-rigged upon their arrival.

France sent over a large number of Bleriots and also several squadrons of Morane monoplanes, which were used for training purposes. Still, the shortage of engines was a most serious problem, and in order to stimulate production large grants of money were made by the British government to engine builders in Spain, Italy and the United States. The companies receiving these grants were previously engaged in the manufacture of automobile engines, and it was, therefore, comparatively simple for them to transform their plants for the production of aeroplane engines.

Turning momentarily to the subject of seaplanes, it is of interest to note that a number of small shipbuilding companies in England, that had been building pleasure boats and yachts, were employed in the manufacture of pontoons and bodies for this type of aircraft. I might point out that right here is an example which the United States would do well to follow, instead of turning over this feature of seaplane construction to desk and furniture factories that are in no wise prepared to undertake properly such intricate designing as pontoons and boat bodies, as is sometimes the American practice.

To get back to general production, however: Every garage and machine shop throughout Great Britain was given a representative of the government and loaned money so as to enable them to undertake the manufacture of such aeroplane parts as their equipment permitted.

As regards machines for school purposes, the engines were soon standardized and manufactured throughout Great Britain in hundreds of factories. Women labor was brought into service quite extensively throughout the cotton-milling section of Lancastershire and the lace-making section of Nottinghamshire, in the manufacture of the wings and for sewing the linen around the different sections of the aeroplanes. Today there are factories in Great Britain that employ as many as five thousand women for this class of work. In the departments of these factories where the "doping" or varnishing of the wings takes place the women often suffer from a form of nausea due to the fumes of the "dope," but they patiently endure this discomfort in order to serve the nation.

Throughout the New England States of this country woman labor is used to a very large extent on luxuries. This labor, conceivably, could be employed in the production of standardized parts and would greatly help in establishing and maintaining a constant stream of aeroplanes crossing the Atlantic for service in Europe. And according to the statement of Sir Douglas Haig that one aeroplane is equal to the services of 2,000 men on the ground, it is immediately evident that this help would materially effect the fortunes of the war.

A word of warning may be apropos here with regard to the operation of government-controlled aircraft factories. Great Britain has learned a terrible lesson, and at a great cost of human life, regarding the methods which she adopted at the commencement of the war, particularly with respect to government-controlled and operated plants. Indeed, the supremacy of the air would have been established six months in advance and hundreds of Britain's best pilots would have been saved if the government had not interfered with private manufacturers by favoring those aircraft builders who had the greatest political influence and shutting out altogether those who lacked in nothing else but political influence. Hundreds of machines were ready for the Western front, and these same machines were of the type that came to that front after the big shakeup in the House of Commons, when the Royal Aircraft Factory was investigated. Had these machines been turned over to the army instead of to the navy, since the navy had no actual fighting to do at the time, the supremacy of the air would have been in Allied hands six months in advance of the time. So it is evident that the efficient handling of the air service is not a matter to be adulterated with politics.

What Became of the American Machines Shipped to Europe?

The American machines that were sent to Europe in the early days of the war served a purpose—an extremely worthy purpose at the time of the world's greatest crisis—even if they were not available for use at the front. They were used for instruction purposes only, and because of the great shortage of engines a large number of these machines were disassembled and their engines used in other types of aeroplane. Another reason for the disassembling of these American machines was because the workmanship, in some instances, was found to be of a very low order.

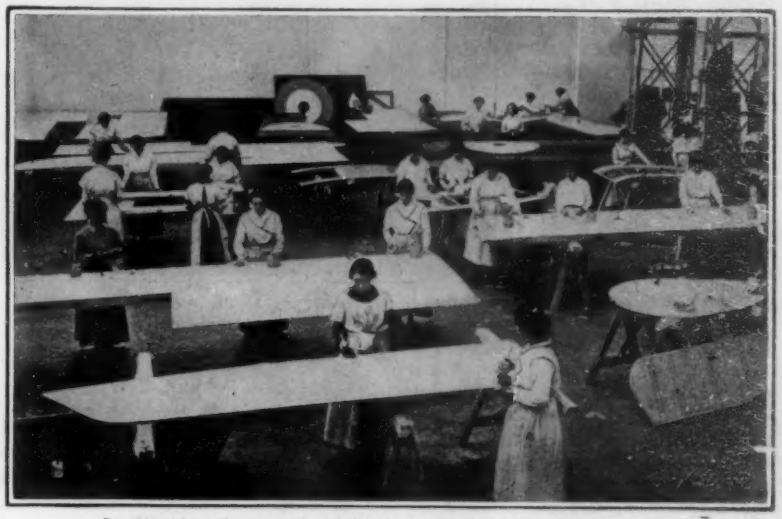
The machines from this country might have been of more use to the British if they had had a stick control, that is to say, a stick instead of a wheel control. The greater part of the machines in use today on the Western battle front, enemy machines included, use the stick control. In fact the entire design of the American machines was wrong, and they were called "aero-autos" by the pilots of the different aerodromes because when they were placed alongside the latest French and the older varieties of French and British machines, they looked so completely out of place.

As I stated in my previous article of this series, 98 per cent of the pilots were put on the Maurice Farman machines, following which they were, in a number of cases, put on American machines because they were faster than the junior instruction machine; but the main difficulty in this connection was that the American machines were controlled by a wheel instead of a stick, and a pilot leaving a machine with that control and going on to a service machine that he was to fly had to change his method of driving. So great was the change from the stick to the wheel control and back again to the stick control that it resulted in numerous crashes.

The long and short of it is that the government was in urgent need of machines and took any machine that came along, and even today they are still ordering some machines of American manufacture, which are of a high order as compared to the machines of two years ago.

Machines every bit as good as the French and British types would be crossing the Atlantic by shiploads right now if one-quarter of the money that has been expended here on high-explosive shells had been spent on subsidising or loaning money to automobile manufacturers. I have mentioned these facts in order to cast some light on the fate of American machines in Europe, for there seems to be considerable mystery regarding this subject in this country. And I am endeavoring to tear away the veil that has been placed over the eyes of the American public by certain parties, with regard to the status of American machines. For instance, one article supposed to come from a committee on preparedness stated that the American machine equaled, and in some cases excelled, in speed and safety and fighting power, the best types of German, French and British machines. It is because of assertions such as this one, coming from supposedly reliable quarters, that so much harm is apt to be inflicted at such a critical stage in this country's history, and I was very glad indeed, to hear Lieut. Fortescue of the United States Army contradict this statement in the *Washington Post* recently. I have met representatives of the Navy Department and the Army of the United States Government, who went over to England and France to investigate aeronautical conditions, and I know from statements made by some of the leading American engineers and aeronautical designers, notably Orville Wright, that such a statement as I have quoted before is absolutely untrue, misleading, and extremely dangerous.

Women at work in the rib shop of a British aeroplane factory, undertaking successfully this most difficult work

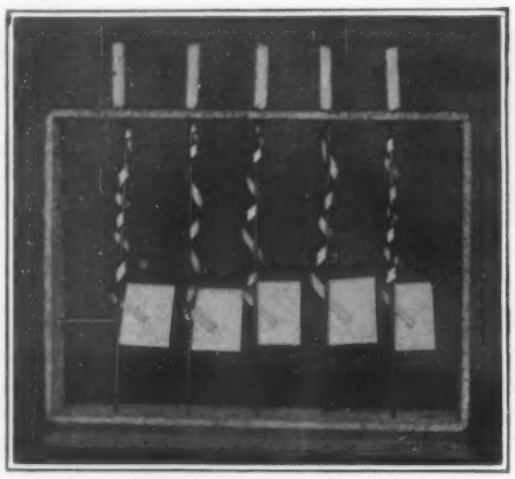


In the "dope" room of a British aircraft factory, where the women workers varnish the linen wings

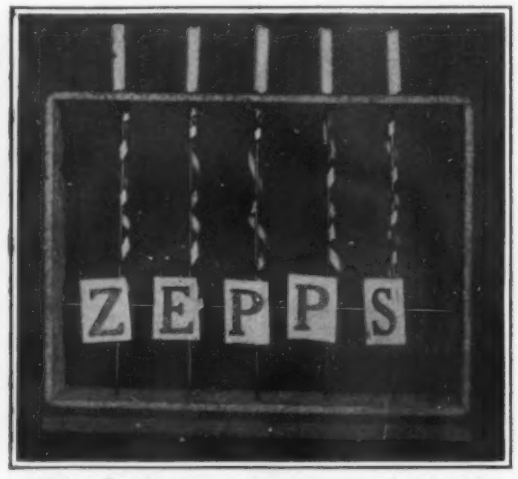
Zeppelin Barometers

THE observed fact that Zeppelin raids usually coincide with the weather conditions revealed by passage of the barometer through "change" to "dry" has given considerable vogue in England to the clever little barometers which we illustrate. Both of these devices depend upon the tendency of damp surroundings to take the gimp out of a tightly twisted cord, and of subsequent dryness to restore the kinks, with considerable torsional effect.

The first "Zeppelin barometer" consists of strips of jewelers' foil, coated on one side with a varnish to increase their susceptibility to the effect just noted, fixed above and free below, and twisted spirally about upright wires as shown in the cut. The length and the tightness of the twist are such that the torsion produced by change from ordinary damp weather to ordinary dryness will cause a half turn of the free lower end. To this end is attached a little card, blank on one side and lettered on the other. In damp weather the blank sides face outward; but when a fine day comes and dries cord and varnish, the cards execute an about-face, and display the warning "ZEPPS." When a cord becomes permanently slack, adjustment can be made by twisting it some more, the peg above the frame at the top serving for this purpose.



In damp weather the blank backs of the cards face the observer



When dry days come they turn around and spell out their warning

The second device is perhaps even more ingenious, certainly more attractive. A model Zeppelin is supported in its shed upon the upper end of a stiff wire. This wire in turn rests upon the end of a light wooden platform pivoted so as to swing in the open space beneath the shed and the "ground" on which it rests. From this pivot point a twisted catgut is stretched vertically to the top of a little mast. The platform is counterpoised so that very little force is required to move it; and as the gut kinks up under the influence of drying weather, this force is supplied. It is to be noted that it is not the longitudinal tension of the gut that swings the platform, but its torsion, just as though it were a rigid handle fixed to the platform and rotated axially. Our diagrams explain the working of this little apparatus and show how, when the platform swings, the Zepp emerges from its shed, to give warning, if not of Zeppe, at least of Zepp weather.

Great U-Boat Peril

By Hudson Maxim

LORD CHARLES BERESFORD has recently emphasized the fact to the people of Great Britain that the German U-boats are rapdily getting a stranglehold on the British Isles, and that the British people in those islands must practice the most rigid economy to avert absolute famine and the loss of the war by the Allies before they have time to overcome Germany.

The truth is the Central Powers and the Entente Allies are in much the position of two fighting pugilists, the eyes of each of whom are nearly closed by the vicious blows of the other, and each of whom has got the other staggering and going, so that a well-directed chance blow may win the fight for either. The U-boat is striking at the solar plexus of England.

The English and French are making good progress on the Western front, and the English in Central Asia, but the progress is not rapid. It will take at least three years longer, even with the help of the United States, to push Germany back within her original frontiers.

Besides, there is the great Russian problem. The condition that prevailed in Russia prior to the Russian Revolution closely resembled the condition in France just prior to the French Revolution. Contending factions drenched France with blood, and anarchy ran riot. We hope for better things for Russia. The Russians are more patient and less emotional than the French. Nevertheless, while we hope for the best, we should be prepared for the worst, and we should at once send helpful commissions to Russia, to encourage the Russians and we should fill the depleted Russian purse with gold coin. Everything possible should be done and done at once to encourage and sustain Russia and to prevent her from either being led or compelled by Germany to make a separate peace. Should Russia make a separate peace, an army of more than 1,500,000 Germans would be released from the Eastern front and thrown upon the Western front.

We should immediately send a million men to be trained in France, and we should exert our utmost to keep up the food supply of the British Isles. Not only this, but we should do likewise for France and Italy, for they too have a food problem no less menacing than that of England.

But how are we to send troops and food over the sea, infested as it is with the ubiquitous U-boats? Aye, there's the rub. There is at the present time no way nor means being employed to do this.

According to the most reliable authorities, the Germans have sunk, since the renewal of unrestricted U-boat warfare, more than 1,600,000 tons of Allied shipping—more than 1,000,000 tons of which was British shipping.

The Central Powers are devoting their entire shipbuilding capacities and energies to the building of U-boats. The U-boat has been standardized. All parts of the boats are interchangeable one with another. These parts are being made rapidly all over the empire, and U-boats are being assembled and put into action at the rate of more than one a day—according to some estimates, two a day—while there are grave fears, which appear to be pretty well substantiated, that the British are not sinking per month as many U-boats as Germany is turning out per day.

This means—and there can be no other meaning—that Great Britain will be starved into submission before her armies at the front, with all our help, can by any possibility win the war.

Judging from the best possible information available, it is practically a mathematical certainty, that unless something is done to meet the U-boat menace, and prevent the wholesale destruction of British shipping, the entire merchant marine of Great Britain will be destroyed in less than a year, and possibly within seven months.

The prospect is horrible enough, and every American citizen should wake up to the realization of the terrible situation that confronts us, stark in all its ghastliness, for if Germany should succeed in crushing Great Britain, then Germany, with the British navy out of the way, would be able to crush us like a puff-ball, with one swipe of the mailed fist.

When we look upon the home scenes about us and into the faces and eyes of those we love, we must realize that within even but a few months these scenes may be devastated, the home made desolate, while we ourselves, made mad with unrealizable realities and horrors, may, impotent and helpless, be compelled to witness those loved ones writhing in the grasp of the lecherous invader.

A wave of patriotism is sweeping the country like a prairie fire, but we can not back-fire merely with the flame of patriotism against the liquid fire of the Germans. Patriotic citizens from Atlantic to Pacific are willing, anxious, and fretting to do their bit.

We have the numbers, the money, the spirit; but no amount in numbers, no amount in money, and no amount of spirit, can save us unless those things are directed wisely. It is not how much we can do, but what we do that is going to help most. We are the present time devoting our energies and our money largely in misdirected efforts.

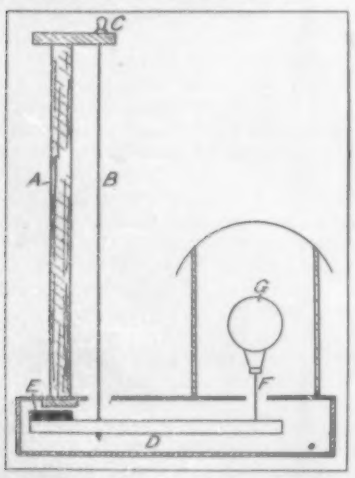
We should immediately stop all work on fighting ships, which we do not need and which we can not use in the present war. Our allies already have a surplusage of big fighting ships, battleships and battle-cruisers, but they are unable to protect their merchant shipping. They are impotent against the U-boat. Of all things that we least need is fighting ships at the present time.

There is but one thing which can be done to meet the U-boat menace, and it is a thing that has not yet been done. It is to build torpedo-proof freight ships and troop ships to take food and men over the seas.

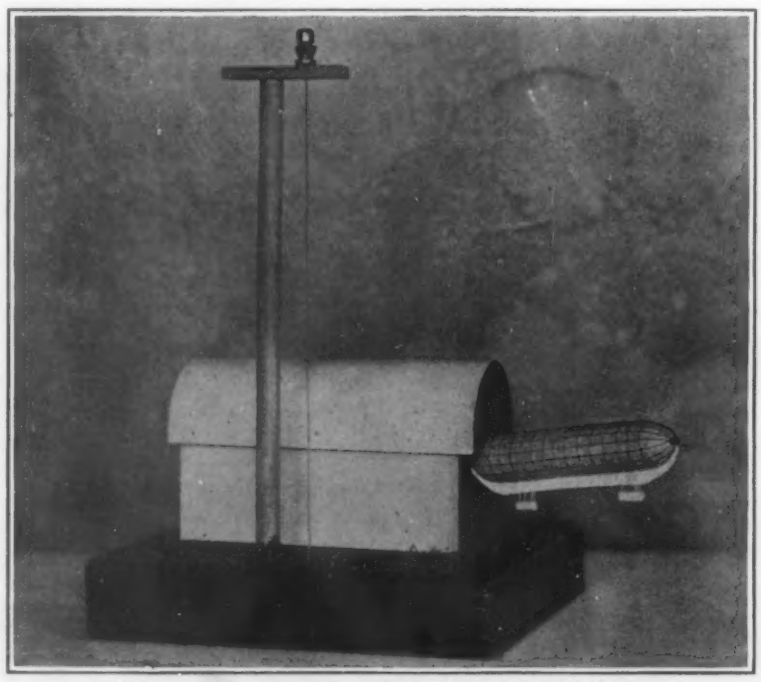
But the question naturally arises—can such a ship be built, and if it can be built, why has it not already been built?

Not only is it possible to build large torpedo-proof freight ships and troop ships, but it is perfectly feasible and practicable. I am informed that the experts of the United States Navy know how to build such torpedo-proof ships by plans already tried out and proven. There are various ways to build large ships which can not be sunk by torpedoes in crossing the ocean. I have gone thoroughly into this matter, and I am very well informed as to what has already been done by others, and while a method of protecting a hull of a ship

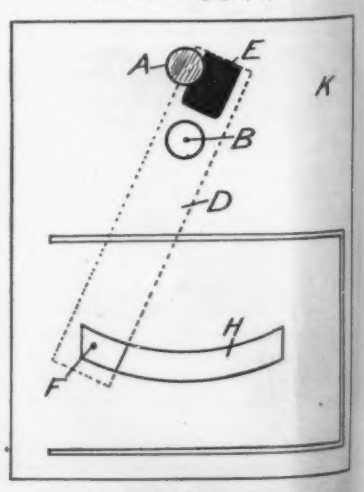
(Concluded on page 478)



Sectional elevation of the Zeppelin barometer



With the coming of Zeppelin weather the tiny dirigible emerges from its shed



Ground plan, using same letters as in elevation

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

For Inventors Must Invent

By Homer Croy

ALTHOUGH there now repose in the Patent Office in Washington grants for more than a million patents, the stream of applications for new inventions never ceases. In fact, instead of diminishing the stream seems to get bigger, so that one naturally begins to speculate as to when all the things in the world will have been patented. Edison says never, for according to him we are just beginning the era of mechanism. The patents that have gone before are merely a few playing blocks in comparison to the ones that will come in the future.

Wilder than the dreams of Edison are the actualities presented at the Patent Office for registration and to them are granted papers protecting them from imitators —on inventions and appliances that one wonders who could be so mad as to wish to imitate. For instance, one of the grants protects a tornado-proof house. The house is built on a pivot that swings with each varying wind; it works on the principle of a weather vane, so that the hardest wind that blows merely turns the house with its head to the breeze, without wresting it from its foundations. Strange to say, the inventor does not live in Kansas; instead, Brooklyn is his home.

Inventors may be spurred on by remembrance of the fortunes that have awaited the patentees of small odds and ends. The idea of attaching an eraser to a lead pencil brought $100,000 to the inventor, and the man who invented bath towels built himself a palace. One cannot be long among inventors without hearing of the man who invented metal caps for bottles. The metal cap was to cover ginger ale and beer bottles, but the suggestion was greeted with ridicule. "No one wants a metal cap on a bottle when cork answers every purpose," people said. But the inventor persisted; he kept on for six years before he found a man who believed in his idea to such an extent that he would back it with money. The first year that the metal cap was on the market the inventor and his backer made $54,000 each. Another man with a simple scheme fraught with great possibilities, conceived of cutting a hole in a small circle of paper and pasting the paper on the end of a shipping tag to keep the cord from tearing through; at last he got his tag on the market with the result that he now has branches in all the large cities.

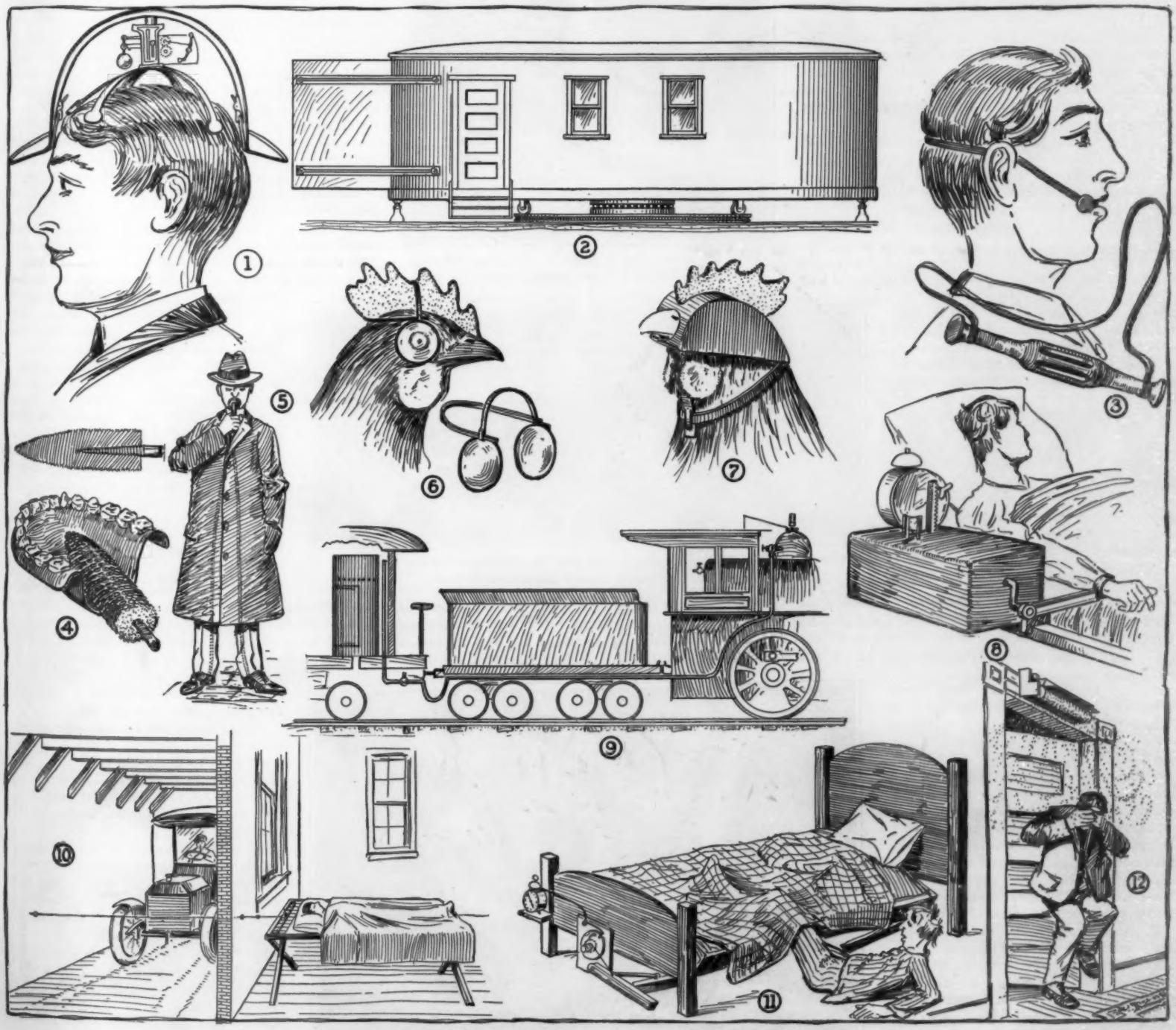
Often in inventions the smaller the idea the more money there is in it—providing enough people use it. Some such idea must have spurred the inventor of the "pedal calorificator." Living in the country, exposed to the wintry winds, it seemed to him that everybody in the world needed a patent warmer that would keep his feet snug and cozy. Why not blow on his toes as he did on his finger tips in cold weather? So he arranged a rubber tube worn under the clothes, with a branch leading to each foot, supplied by a mouthpiece at the top. When one felt cold he merely had to take out the mouthpiece and breath into it a few times.

The first requisite in an invention is that there should be a demand for it. One hesitates to feel that this is true of the invention of the man who focused his genius into the perfecting of a polisher for false teeth. Evidently thinking of the necessity for a low manufacturing cost, he so perfected it that a corncob may be used. The principle is so simple that the reader will surely condemn himself for not having thought of it. It is merely the end of a corncob stuck on a stick, which, rubbed against the teeth, brings them to the right degree of brilliancy. It must be stated, however, that the invention did not revolutionize the prevailing method of leaving the article to be polished in a cup of water over night and attending to the details the next morning with a towel.

Along the same line was the invention of a resident of Somerville, Tenn., who wished to find something that would appeal to everybody, and as a result perfected a locket for carrying chewing gum. The locket, which looked like a vanity case, swung from the neck by a gold chain and opened by touching a spring. The locket was lined with porcelain so that no one could complain that it was not sanitary, but in spite of this the locket has not yet found a very widespread sale.

Some inventors work on the principle of perfecting

(Concluded on page 475)



Some curious inventions on which our government has granted Letters Patent

1.—Automatic hat tipping device for the polite, but lazy man. 2.—Tornado-proof house that works on the principle of a weathervane. 3.—A bit to curb snoring. 4.—New use for corn cobs—polisher for artificial teeth. 5.—Keeping the toes warm by breathing upon them. 6.—The bespectacled fowl does not have its eyes pecked out. 7.—This eye shield prevents chickens from flying over the fence. 8.—A noiseless alarm that rouses the sleeper by shaking him. 9.—Steam-jet system to foil the train robber. 10.—When the string breaks the bed collapses and the keeper of the garage is awakened. 11.—This alarm throws a late sleeper out of bed. 12.—A shower of cayenne pepper to thwart the burglar.

The blind-sight in normal position with the trigger under it — The firing position, making possible a firm, steady grip — The hind-sight elevated for long range work

New rifle invented by a Brooklyn man, in which a thumb-piece displaces the ordinary trigger

A New Military Rifle

By A. B. Bowers

THE regular army rifle, while in most respects an admirable weapon, is, in the opinion of many competent observers, open to grave objections on more than one ground. In the first place, the trigger by which the rifle is discharged is located below the stock, between narrow open-sided guards, which are far from a sufficient protection.

Moreover, the manner of discharge, by pressure of the forefinger on the trigger, produces, in many cases, a sidewise and downward movement of the whole barrel sufficient materially to affect accuracy of aim.

A far greater measure of inaccuracy in shooting is caused by the short distance between the sights. The back-sight is too far forward—from twelve to eighteen inches from the eye. This defect cannot, however, be remedied offhand; for with the open back-sight used, this distance is necessary for accurate focussing of the two sights upon the target.

Long barrel guns have been used, to correct this fault by putting the fore-sight farther forward, thus increasing the distance between the two sights; but the inconveniences of such weapons more than balance the gain in accuracy.

The placing of peep-sights on standards secured to the grip of the gun constitutes a more plausible remedy for this difficulty; but even this has, when looked into more closely, serious drawbacks. Such sights are in the way of the hand in firing; they prevent a good grip of the gun, they are too near the face and the eye for complete safety against recoil; the length of standard necessary to bring the sight to the proper elevation for the eye is excessive, so that the danger of breakage is greatly increased, and constant care has to be exercised to keep it from blows which would knock it out of alinement. In addition to all this, when this sight is placed upon the bolt-lock gun now in universal use it must be hinged to permit of turning down so that the bolt may be brought back for cocking, rejection of shell, and recharging. These operations accomplished, the sight must then be raised for sighting.

Further fault is found with the open V-shaped back-sights. With this sight, not only must the fore-sight be on the target, but it must also be brought into exact alinement with the bottom of the V forming the back-sight. This takes time and is not easy to do.

Again, many users of rifles carry them at full cock so that they may be ready for instant use. Various devices for locking the cocked guns have been devised, and one or another of these is found on most guns now made; but they are all subject to the fatal objection that they take almost as long to unlock as to cock the gun without them.

Finally, in cold weather, when the hand needs protection, the rifleman is in a sad dilemma. The gloved finger is too stiff to manipulate with safety the trigger now in use, while a mitten, though even warmer than a glove, must be removed altogether.

A Brooklyn inventor has eliminated these various defects, so he claims, in a new gun recently patented. In the first place, he has substituted, for the old, projecting finger-trigger under the stock, a thumb-trigger above the stock. In operation it is only necessary to tighten the grip of the hand slightly in order to work this trigger; and at rest it is possible to guard it by a five-sided guard.

A long sighting range has been obtained, without any of the disadvantages enumerated above, by attaching an orthoptic or peep-sight to the firing pin. In this way is obtained a broad base, sliding in closely fitting guides that preserve the alinement. Not only does this give the desired long sighting range, but, bringing the back-sight to within four inches of the eye, it permits the use of a peep-sight so very tiny that aim must necessarily be accurate. The conflict between cocking and locking is automatically eliminated; for the base of the peep-sight so completely covers the thumb-trigger, when the gun is at cock, that the necessity for locking is wholly removed. Finally, the motion by which discharge is accomplished is such a simple one that it can be made without the slightest difficulty, regardless of whether the hand be bare, gloved, or mittened.

Here the armor-clad inventor is receiving, unhurt, the blows of a ten-pound sledge

How would you like to don this armor and face a string of bullets coming at half a mile a second from a distance of 60 feet?

Bullet-Proof Armor

THERE is a suggestion of the medieval in the curious suit of armor shown in the accompanying illustration; but so far from being medieval, it is very much up-to-date, having been designed, indeed, for resisting shrapnel and the high-velocity modern bullet.

The shield is the invention of Dr. Guy Otis Brewster, of Dover, N. J. It was designed to cover the head and body, and the total weight of the armor is 30 pounds; which, in view of the remarkable protection afforded, as shown in recent tests, is not an undue amount of weight to carry.

As will be noted, the armor is built to a V section, the object, of course, being to afford an inclined surface and cause the majority of the bullets to strike at an angle.

The armor is made of steel of a special composition, which is worked so as to give it the necessary hardness and toughness. In the tests made before Army Officers at Fort Picatinny, Dr. Brewster, as shown in the illustration, donning his suit of armor, stood at a distance of 60 feet in front of an Army sharp-shooter, who deliberately shot at him with a Springfield .30 army rifle. After the man had let off a string of shots, the Doctor, simulating war conditions, charged him with a bayonet.

In another test, of which we show a picture, a man with a ten-pound sledge rained heavy blows on the steel-clad victim, who came through the ordeal without any hurt. Of course, a cushioning element is interposed between the armor and the head and body, and the energy, both of the bullets and of the sledge, was absorbed largely by the inertia of the armor

Novel Seed Sowing

A BULB grower has introduced an ingenious method of sowing seed. Long strips of narrow paper are first of all prepared, upon which the seeds are pasted at intervals. The space allowed between the seeds depends upon the kind. In some cases two or three inches may be needful, in others only an inch. Many yards of the strips are prepared in this way and wound upon a wooden reel.

The method of sowing is simplicity itself, when this plan is followed. The trench is opened up to the required depth. Then one end of the paper strip is pegged down on to the soil and the reel of tape is unwound according to the length of the trench.

An enormous saving of seed is effected and, what is perhaps even more important, the seeds are sown at exactly the right distance from each other. Any danger of overcrowding on the part of the seedlings is eliminated.

For long it has been realized that seeds planted singly gave the best results of all, but hitherto the plan has been regarded as too laborious. In the system under consideration the sowing is carried out with the greatest ease. Naturally, the paper tape soon rots away in the soil and it is not found in any way to affect the development of the seeds.

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Torpedoing the Enemy's Trenches as a Preliminary to Infantry Attack

(*Concluded from page 463*)

In the models thus far constructed two types of power plant have been favored: one, a self-contained type, is equipped with fuel supply tank and burner so that it can generate its own steam after its release; the other, having no burner nor fuel supply tank, is intended to be supplied with only the required amount of steam from a central supply station or otherwise, or, if desirable, the steam can be generated before launching by its own burner which can then be removed. Aside from the question of relative cost, the latter has certain advantages arising from its lighter weight and greater load-carrying capacity. In either type a standard steam-automobile engine of the two-cylinder, simple double-acting design is used. The boiler is a standard steam-automobile 14-inch boiler. So much for the power plant.

All four wheels of the land torpedo are rigidly fixed to the axles which revolve. The engine is directly geared to the rear axle, which in turn is connected by chain drive to the front axle, thus giving the vehicle a four-wheel drive. The wheels are spiked in order to secure greater traction effort over the roughest terrain, and the device, it is believed by steam-automobile experts, should be capable of carrying a load of 150 or 200 pounds of high explosive at a speed varying, of course, with the ground conditions. Over smooth ground the land torpedo could run at a rate exceeding sixty miles an hour.

Unlike the usual torpedo operating in the water, the land torpedo requires a means of control after it has started on its destructive errand. And to accomplish this purpose, not only as regards the running of the torpedo but also the explosion of the charge, cables are employed. The speed of the car may be controlled by a cable which is connected with a valve in the supply pipe connecting the engine with the boiler, while from a spool carried on the rear axle a wire is paid out as the vehicle proceeds, and at the desired moment a current passed through this wire explodes the charge. The cables, being connected to windlasses in the trenches of the attackers, can be pulled in so as to reclaim any torpedo which has not accomplished its mission or which is headed in the wrong direction. It will be noted that the axles of the torpedo are non-steering, and there is absolutely no steering gear since the vehicle is supposed to keep its course after its release.

With the cost of the land torpedo estimated at something like $150 each, when made up in large quantities, it is evident that its use would materially lessen the cost of assault preparation. As the device is to be employed but once and as its first and last trip would be not over a mile, and probably only a couple of hundred yards, highly finished construction would not be necessary. Providing the torpedo with a light armor would make it immune against the rifle- and machine-gun fire of the defenders, while it is highly improbable that artillery fire could be brought to bear upon it in the short space of time it would require to cross No Man's Land. Moreover, the land torpedo would retain for the attacking force the all-important element of surprise, which is so completely lacking in present methods.

For Inventors Must Invent

(*Concluded from page 473*)

something that will appeal to everybody, something that will have universal use, and some work on the principle of perfecting something that will have only a restricted but almost compulsory sale. An inventor who was the victim of a train robbery, immediately set to work to invent a machine for doing away with such hold-ups. As a result of his studies he came to the conclusion that trains were robbed for one of two reasons: First, for what valuables the passengers might have on them; second, for what valuables there might be in the express car. Further study and observation showed him that 90 per cent of the robberies were for what the express car contained and so his in-

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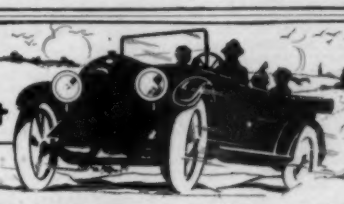

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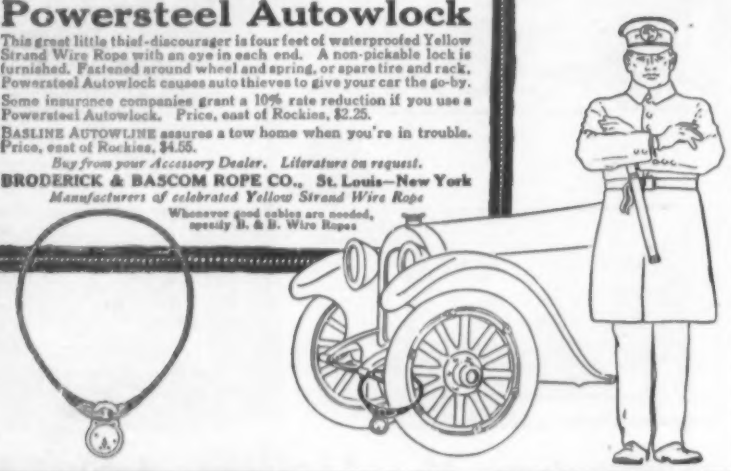

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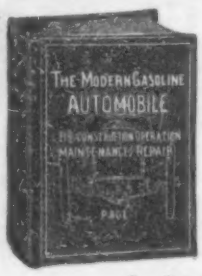

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ventive genius found expression in a machine that he guaranteed would prevent robbers from looting an express car. He found that when a train is stopped the robbers immediately make for the engine and cover the engineer and fireman, then go to the express car. His plan was to have a line of steam pipes connected with the engine worked by a lever in the cab. When the robbers stepped upon the platform of the cab they were to be greeted by a burst of scalding steam; if they escaped this and got back to the express car they were to be scalded with another burst of steam which would cook them, theoretically, to the bone. But it is not on record that any train robber was ever so cooked.

Many people, as soon as they discern the need for something, write to the Patent Office to see if such a thing has been patented, which is all quite legitimate and quite as it should be, but sometimes the questioner expects too much of the office. A Mississippi man wrote: "Has there ever been a water gage invented? If so, is it like mine?" As grants for more than five hundred water gages have been taken out and as he didn't describe his, it was beyond the department to give him the satisfaction he hoped for.

Another man, thrilling with an idea, wrote: "I have invented a medicine that will cure an ailment for which there is a great demand. Can I get it patented?"

Evidently the enthusiasm of the moment keeps the inventor from thinking, else how could one explain some of the patents that have been issued. No doubt a gentleman living in Chicago thought he had perfected something for which there would be a widespread demand when he got out his papers on a device for preventing snoring. It consists of a wooden bit, with holes in it, which is put in the mouth and fastened there by a strap around the head. "It is," he solemnly tells us in his papers of application, "to be used by a person addicted to snoring while asleep."

The alarm clock is a fruitful field for the inventively inclined. It would seem that every person who has had a disagreeable experience with an alarm clock has turned the fire of his genius upon it. They are nearly all inventions to assist the clock in its matutinal duties. One, however, is a noseless alarm clock. At first thought one would say that if there is anything in the world that depends on noise, it is the alarm clock, but this gentleman got around it by inventing a device by which a bag of water was suspended on the wall over the head of the bed. To this was attached an alarm clock. At the hour of going off it released a spring which let the water out of the bag and down through a rubber tube attached to the sleeper's leg. Feeling the cold water he would, theoretically, arise and go about his duties without having disturbed his neighbor across the thin partition.

Another inventor did not fancy having a cold stream of water running down the side of his leg, so he set about inventing an alarm clock that would be both noiseless and at the same time be sure of arousing the one who was putting dependence on it. To this end he invented an alarm clock with an attachment that would shake the sleeper until it had aroused him. The machine did not have a very wide sale, as the inventor had evidently not taken into consideration that people turn over and get out of position during the night, which would put the quietus on the alarm.

A Brooklyn inventor went even further than that, for he perfected an invention that he guaranteed would not only awaken the sleeper but would get him up. His experience was that the weakness in alarm clocks lay in the fact that they didn't make the sleeper get up, so he invented a clock with a mechanism attached to the lower legs so that when the hour came the foot of the bed would fall down, leaving the sleeper half standing.

Inventors all seem to dream of the day when great wealth will be theirs, and then evidently they begin to worry about some one's breaking in and stealing it, for the Patent Office shows any number of inventions worked out to keep away night prowlers. Two New Englanders worked out a plan whereby the intruder could be

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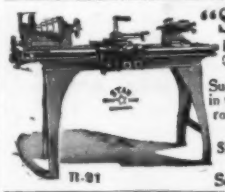

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Pat. Dec. 19, 1916

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THE TOOL OF MANY USES

taken at a disadvantage. Their experience had been that even though a burglar was taken unawares he would put up a stiff resistance, so they perfected their plan to disable the burglar. With this in mind they devised an attachment for the door which would scatter Cayenne pepper in the burglar's eyes. While the burglar was sneezing and clawing at his eyes all the aroused tenant had to do was to slip down and cover him. Simple as it sounds, the police records do not reveal that any great number of burglars were brought in with red and smarting eyes.

The most popular field for inventors is chicken farming. More curious inventions are registered under poultry than under any other subdivision in the Patent Office. It would seem that everybody who has bought a chicken farm with the expectation of getting rich and has failed has tried to bring about that consummation by inventing something to do with chickens. The most common invention is a patent nest egg. Fifteen nest egg patents have been granted; some of them are medicated eggs that will not only induce a hen to lay but by means of a solution that oozes from the egg cure her of any skin disease that may at the time be making life hard for her.

It was left to a Texas man to invent something that the world had been in need of for a thousand years—a mechanical contrivance to keep a hen from getting over into a neighbor's garden and creating neighborhood dissensions. It consists of a hood buckled around the recalcitrant hen's head. The hood is made out of leather and comes up over the hen's eyes so that she can look neither to the right nor to the left, nor up. The only direction she can see is straight down. The inventor discovered that it was a psychological law in the poultry world that a hen will not fly except where she can see; unable to see the top of the fence she will not try to fly over and thus the problem of the scratching hen is solved.

It took two Wisconsin men to solve the problem of inventing a machine to count how many eggs a hen lays. The mechanism fastens on the hen and counts the eggs as fast as she cares to put them in the nest. It is worked on the principle of a fare indicator on a street car. Each time the hen lays an egg it is registered, so that the owner can go out and tell exactly which hens are the ones that are doing the work.

It was a man in Munich, Tenn., who discovered that chickens needed glasses, not so much to make their way about as a protection from pecking each other in the eyes. And on this contention he was awarded a patent by the United States government.

The politest man that the Patent Office has any record of hails from Spokane. He left it to others to solve the poultry problem; he was thinking only of the fair sex. It was his luck on several occasions to meet ladies while his arms were full of bundles, and as a result was unable to salute them as is the chivalrous custom among males in civilized countries. This worried him no little bit and so to the solution of this social problem he set himself and at last invented a device for tipping one's hat on meeting a lady on the street. Inside the hat—preferably a stiff hat—he worked out an invention which rested, by means of prongs, on the head but which could not be seen by an onlooker. On meeting a lady the person wearing the hat had but to bend his head forward. This set in motion a governor and released a spring which not only lifted the hat after the customary fashion but for extra measure also rotated it and then returned it to its proper position on the head.

So the inventions come in day by day, covering every conceivable field of human activity and will probably continue to come in as long as the Patent Office exists.

A Pan-American University

BY authority of the Panama National Assembly, the president of that republic is trying to interest all the countries of North and South America in the foundation of a Pan-American University in the city of Panama.

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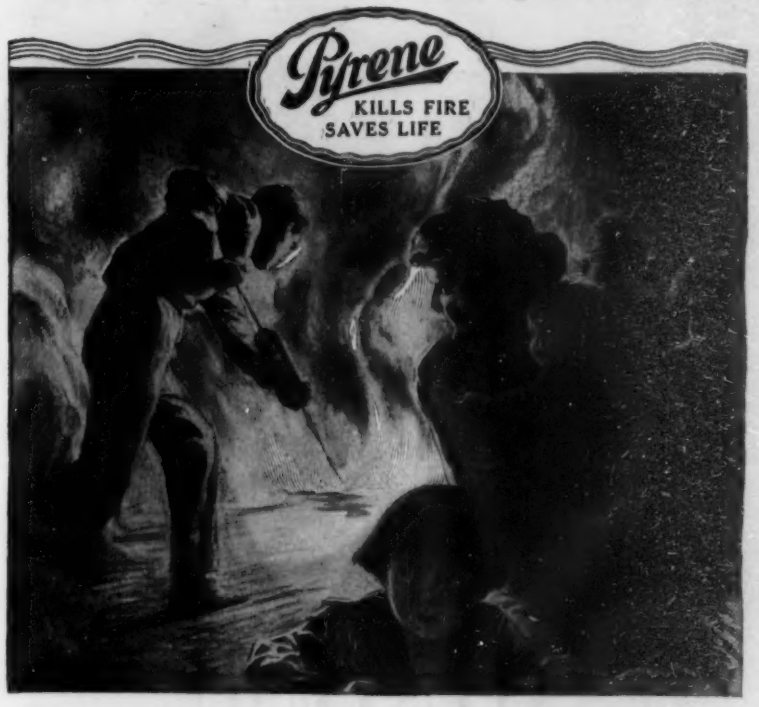

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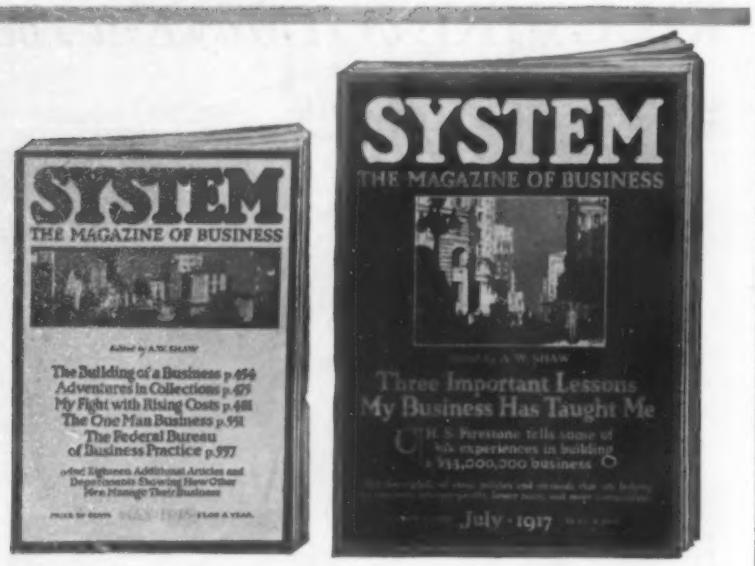
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Three Important Lessons My Business Has Taught Me
July · 1917

THE OLD THE NEW

The New, Big, Better SYSTEM

In form and in editorial excellence SYSTEM is to take a great forward step July 1st.

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The Power of Ideas

But these changes in physical make-up are dwarfed by far-reaching improvements throughout all the reading matter. SYSTEM exists for ideas—ideas that mean *money to you.* It has grown to be a great force in American business by sticking to a single fundamental maxim—there is one best way to do everything, somebody knows that best way—find him at any cost and deliver his message to all. What's the result? SYSTEM itself is a big success, doing an immense annual business—and numerous executives and merchants all over the country owe much of their own success to study of its pages; the files are jammed with letters of thanks from them.

New and Old Features

The "how" departments in SYSTEM will be retained. These are the concise, clean-cut, specific plans and knacks that can be applied at once and directly in a man's business.

There would be a riot among SYSTEM readers—a riot by mail!—if we even hinted at omitting or abridging these. Far from doing so, the quantity will be doubled; the *quality* can't be bettered.

Among the newer features will be a series by Professor R. E. Heilman, who has charge of Economics at Northwestern University. His task is to introduce economic law to American business, let them shake hands, and see how far they can unravel commercial snarls.

Archer Wall Douglas, since last August, has been getting ready for the new SYSTEM, meanwhile doing some work for FACTORY, another Shaw publication. He is going to visualize price fluctuations and business forecasts by chart and "graphs" in a captivating way.

SYSTEM has had original articles by Judge Gary, J. Ogden Armour, C. M. Schwab, John North Willys, Frank Disston, and other business giants, and will in coming months print, from the pens of men equally famous, stories of lessons learned in the dust and heat of business battles.

War and Business

Your business of course is affected by this war in countless ways. Situations come up that are new in your experience. You worry; everybody worries nowadays. You, like all of us, crave light. If other men, here or abroad, have struck snags like those harassing you, how did they get around them?

SYSTEM exists to answer such questions. The puzzles of war are no harder than the puzzles of peace. SYSTEM is organized for both. Its office in London (where for many years it has published an English magazine also named SYSTEM) is furnishing the American end all kinds of information, based on actual experience of English business men since the war began. These leads are invaluable when applied to American conditions by our American editors. This is but a sample of the extent of SYSTEM'S resources in gathering business data.

SYSTEM will deal with war as it affects all sections—East, North, West, South; in small towns and great cities. Whether you are a retailer or an officer of a corporation; whether you are connected with manufacturing, retailing, insurance, real estate, banking; whether you buy, sell or advise; it has something for you.

Save a Dollar---or Several

The present subscription price of SYSTEM is $2 a year, but all these improvements, with the rise in the cost of paper, force the magazine to advance its price on July 1st to $3—*but not to YOU* if we can avoid it. You may have it still at $2 if you act *now.* Write us at once (on your letterhead if you are a new subscriber) simply ordering SYSTEM for one, two or five years. The magazine will begin coming at once. Bill will be sent you in due course based on $2 per year. You save a dollar on each year ordered now. Don't penalize yourself by delay.

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Perhaps you have friends who will appreciate an opportunity of examining SYSTEM. If so, send us a list of them and we will send them a free sample copy.

Great U-Boat Peril

(*Concluded from page 472*)

invented by me would, in my opinion, prove the simplest and most effective, still there are means designed by others which will accomplish the desired result in an effective way.

Surely, the experts of our Navy, utilizing whatever I have done for what it may be worth, and utilizing whatever any other inventor may contribute, for what it may be worth, ought to be able to build large, unsinkable ships with which our soldiers may be safely landed in France, and upon which food may be carried to our needy allies.

I should be very glad freely to contribute my inventions and my services to the work, and I am sure that other engineers and inventors who have useful ideas and inventions which could be utilized would also gladly and freely contribute their services and their inventions.

A competent commission should immediately be appointed to inquire into this matter and find out whether or not such ships of safety can be built, and if so, what is the best way of building them, and what is the quickest way of building them, and then all work on our fighting ships should immediately cease and their uncompleted hulls should be converted into safety troop transports and freight ships.

In consideration of our stopping all work on our fighting ships to provide safe transportation of troops abroad and to supply food to our allies, Great Britain and France should enter into a compact with us to stand by us after the war against all comers for a period long enough to enable us to bring our navy up to the required strength.

The building of safety ships is the way we can best help our allies, and this is the only way that we can save our allies and ourselves, and if this thing is not done, they are lost, and then, nothing under God can save us.

NEW BOOKS, ETC.

PRACTICAL MOTOR BOAT HANDLING, SEAMANSHIP AND PILOTING. By Charles F. Chapman, M. E., Editor of *Motor Boating.* New York: *Motor Boating,* 1917. 8vo.; 144 pp.; illustrated. Price, cloth, $1.00; paper, $0.50.

This excellent handbook appears at a most opportune time and leaves the yachtsman no excuse for ignorance in any situation that may arise. One of the first needs of the beginner is to know how to meet and pass safely under risky conditions. Mr. Chapman's text and diagrams provide so exact and complete a knowledge that the amateur is at once inspired with confidence. Lights for all classes of boats are considered, the various types of buoy are described, and a chapter is given over to Government Navigation lights. The equipment required by law for motorboats is tabulated, the compass and compass errors are explained, useful Government publications are listed, and simple nautical instruments are shown. The chapter on piloting contains definite instructions for laying a course, determining position, and taking soundings. Among other subjects tersely but clearly dealt with are flags and colors, yachting etiquette, signaling, boat handling under sea conditions and steering. Equipment lists include tools and engine accessories, the medical kit, galley utensils and provisions. Navy signaling is dealt with in a final chapter. It will be seen that, aside from its contribution to the pleasurable side of yachting, the handbook is admirably adapted to fitting motorboat men to play that part in national defense which recent developments have forced upon the motorboat. Too much praise can scarcely be accorded the author for the way in which he reduces the most difficult subject to its fundamentals; every sentence goes straight to the point, and each one of the many illustrations has its practical place and purpose.

THE DESIGN OF AEROPLANES. By Arthur W. Judge, A.R.C.S. New York: The Macmillan Company, 1916. 8vo.; 220 illustrated. Price, $3.50.

Aviation, still in its early youth, has found scant time in which to collect in accessible form data and methods of design for the guidance of designers, draughtsmen and students. These papers set down, from the standpoint of the mechanical engineer, the principles underlying aeroplane design together with may useful tables. Among other important considerations the work deals with the estimation of aeroplane weights, characteristic curves of performance, stresses, construction of the wing system, and undercarriage practice. The tables include strength and proportion of materials, weights, equivalents, and general information, and there is a bibliography and a full index. The manual, one of an aeronautical series, offers a valuable compendium for the student and worker in this comparatively new field.

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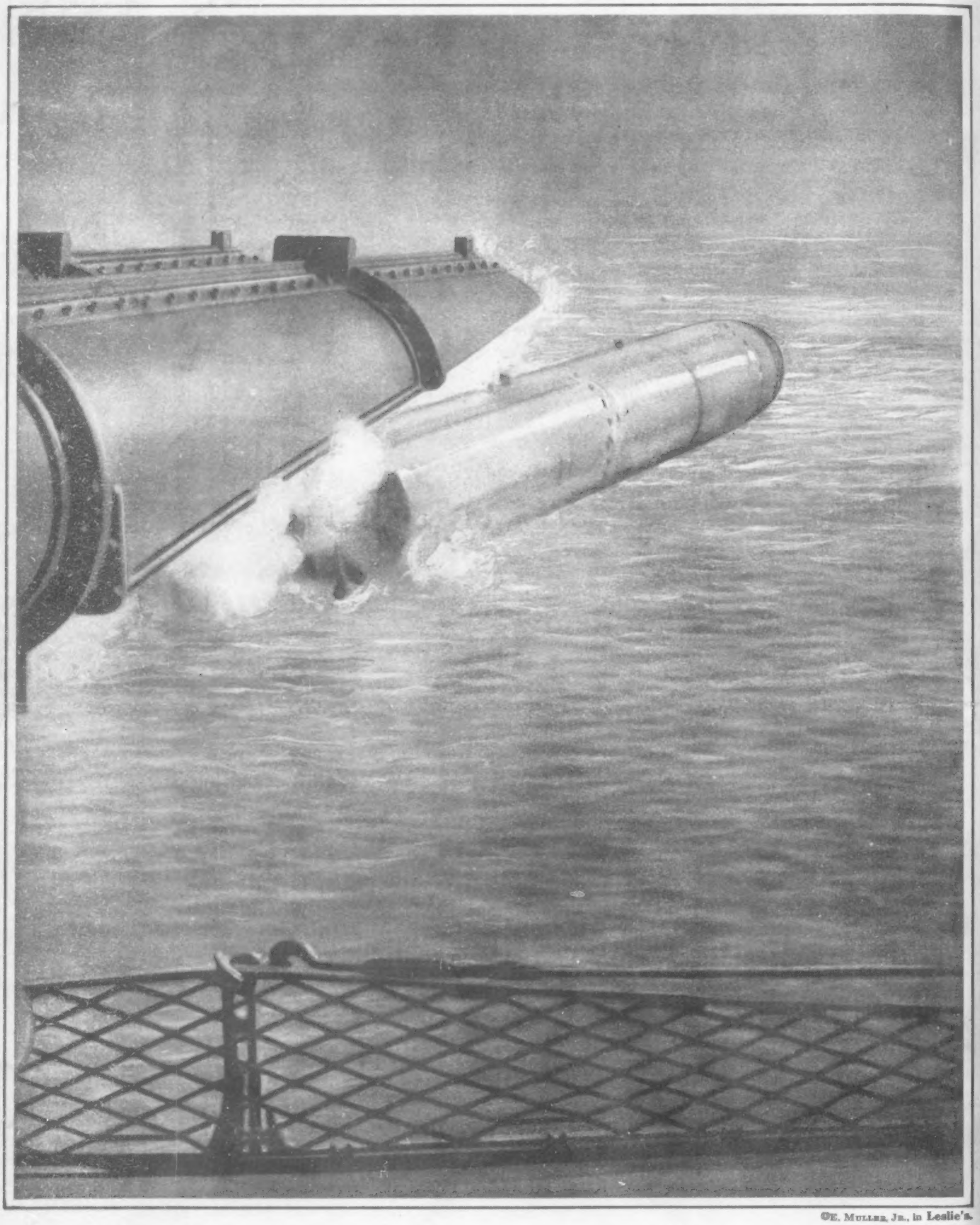

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MOTOR TRACTION IN MODERN WARFARE—[See page 486]

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7-passenger Touring, $1650 **7-passenger Sedan, $2300**

3-passenger Roadster, $1585

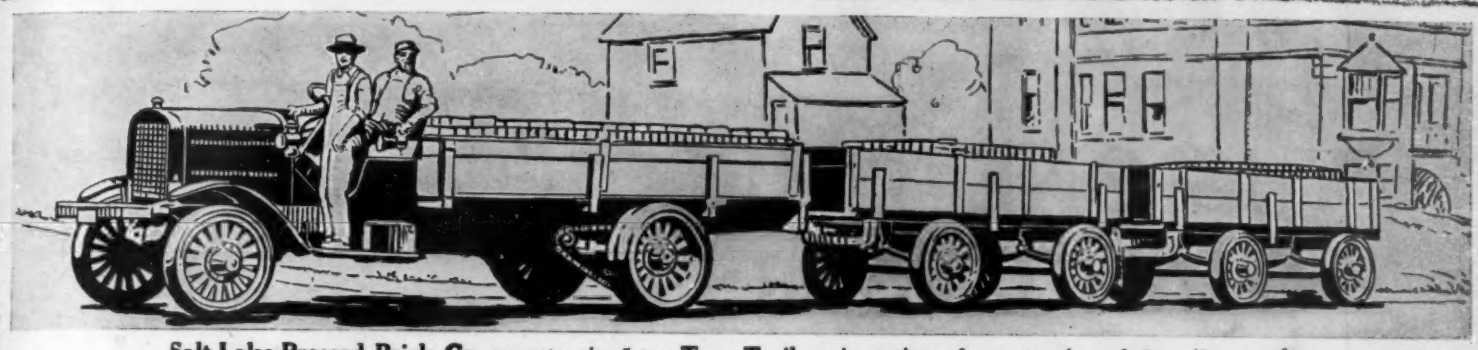
F. O. B. Detroit

ALL PRICES QUOTED MAY BE ADVANCED AT ANY TIME

Write for descriptive matter and name of nearest dealer

KING MOTOR CAR COMPANY

DETROIT



Salt Lake Pressed Brick Co. operate six 5-ton **Troy Trailers** in trains of one truck and 2 trailers each. They figured their saving last season over trucks alone was $3100. They realize that TIME is the big element in keeping transportation costs down.

Using the excess power that every truck HAS, but which most truck users WASTE—

Your 3-ton truck cannot ***carry*** 7 tons—nor can it carry much over its rated capacity, because it is built only to ***carry*** that weight—its springs are designed to carry 3 tons—its axles, as well as all its construction, are designed to ***carry*** 3 tons. But, its motor is designed to ***pull*** the same 3 tons up ***steep grades,*** as well as through the heaviest kind of going. This means that the same truck has ***excess power*** to ***pull,*** under average conditions, as much or more than it can carry, and ***carry its full load at the same time.***

What becomes of this wasted power in YOUR trucks today? Why don't you utilize this excess of power? Why have a motor in every one of your trucks when the motor in ***one of your trucks*** has power enough to pull itself and also 1 or 2 other ***motor-less*** trucks.

"Troy Trailers"

The power which your truck now wastes can be turned into profit by using a Troy Trailer. The original investment in one Troy Trailer is only about one-third the cost of a truck of the same capacity. On this basis you can eliminate extra trucks, save the wages of 1 or 2 additional drivers—haul more loads every working day and convert your hauling losses into profits.

We are placing the hauling methods of hundreds of firms on the new basis of ***"service and economy."*** We know hauling costs in every line of business—under almost every condition.

We have awakened thousands of truck users to the real hauling efficiency of their motor trucks.

The largest concerns in the world no longer base the hauling of their trucks upon their trucks' carrying capacity alone. We have shown them how, by using Troy Trailers, they were able to deliver loads two times greater than with their trucks alone. And all this increased efficiency at the insignificant increase in maintenance cost of not more than 10%.

Troy Trailers are used by such nationally-known concerns as:

John Wanamaker	Goodyear	Ballantine Brewery
Eastman Kodak	Essex Foundry	American Dock Co.
Cadillac	Scovill Mfg. Co.	Park-Davis
Studebaker	United Cigar Stores	Armour
Packard	Victor Talk. Mach. Co.	Swift & Co.
Firestone	Ruppert Brewery	

and hundreds of others equally well-known.

Troy Trailers are made in capacities of 1 to 5 tons and with any type of body. They are built for use as a single trailer or in trailer trains. They are reversible, and therefore can be backed up to any loading platform, or backed into any alley, as easily as if they were being moved forward. They can be coupled to the truck at either end, thus proving great flexibility. We also make a line of Troy Juniors to be operated with small trucks or pleasure cars.

United Cigar Stores Co.:
Operate a 5-ton Troy Trailer with a Packard Truck.

Ford Motor Co.:
"Since putting into operation the two Troy Trailers, we have been able to do the work with three trucks that formerly required five. There is no question but what trailers are a great saving."

5-ton truck hauling 21 tons in one load

Schmidt Brewing Co., St. Paul:
"We find the Trailer trails absolutely perfect, and we are glad to recommend it. We believe every truck user will eventually become a Troy Trailer user."

Riker-Hegeman Co., New York:
"We figure that the Troy Trailer saves us one automobile, which means somewhere about $100 a week. We expect to put on another trailer and do away with another automobile. In our estimation the Troy Trailer is the coming means of transportation as far as economy is concerned."

Troy Trailers will operate with ANY Good Truck

It requires as much engineering skill to build a Troy Trailer as to build the best truck. Every hauling condition encountered by trucks must be considered. A Troy Trailer is a special piece of machinery built to stand up for years and years under severest service—to meet every hauling requirement of every business—to travel at a speed of from 1 to 15 miles an hour under load—to attach quickly and easily to any truck, and stay attached.

The specially designed draw bar construction on a Troy Trailer has a spring that works on both pull and push, preventing shocks from sudden starts and stops, relieving Trailer and motor truck of every possible strain. This pull is through the Troy Trailer frame and springs—not through axle and wheels.

Troy Wagon Works Company
Troy, Ohio
Branches or Distributors in all principal Cities

How to Figure **What Any Truck Can Do**

S. A. 5-19-17

The Troy Wagon Works Company
Troy, Ohio

Without any obligation to us, please send copy of booklet advertised in Scientific American, and name of nearest representative.

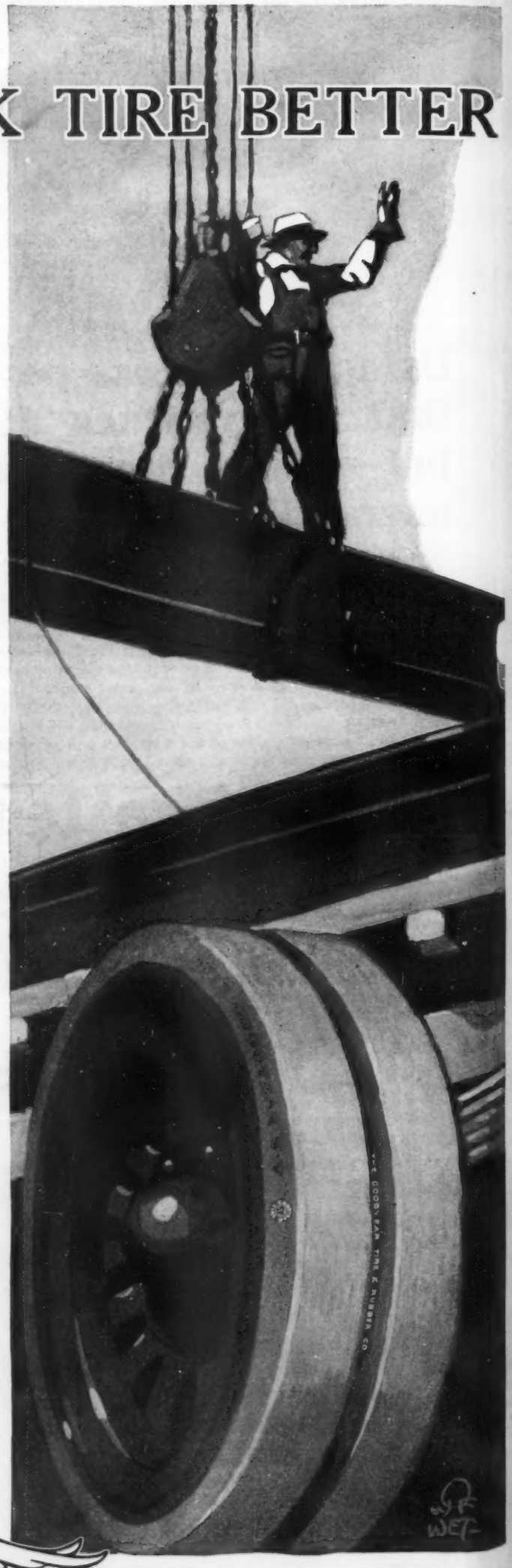
Name.....

Address.....

Business.....

GOODYEAR S-V TIRE

WHY IS ONE TRUCK TIRE BETTER THAN OTHERS?



In all kinds of service, on all sorts of roads, in all states and many countries, the Goodyear S-V Pressed-On Truck Tire has proved its marvelous superiority.

Proved it by resisting wear through many extra thousands of miles, by providing perfect, power-saving traction, by pillowing huge loads on rough roads and smooth, by doing all the things a tire can to reduce the cost of efficient cartage.

Why is the S-V better? What gives it so much greater resilience and durability?

Design is one factor. A cross-section of the S-V shows gum distributed to form the most efficient cushion of which solid rubber is capable, to present the broadest possible surface to road wear and still resist all cutting and chipping at the edges.

The method of molding counts, too. S-V is pressed out from a patented machine which knits the millions of tiny particles into a wear-defying mass.

But what's *in* the tire counts most. New rubber only, of the highest grade, is used. No shoddy ever finds its way into S-V's. Minerals are necessary to attain the proper toughness, but in this tire there is more rubber in proportion to the mineral than in others.

These are the final reasons for S-V superiority. They account for S-V's marvelous performance—mileages up to 20,000 on country routes and 40,000 in strenuous city service.

They tell why one truck tire is better than others.

The Goodyear Tire & Rubber Co., Akron, Ohio

GOODYEAR

AKRON